

CIVIL ENGINEERING (CIVL)

See Course Description Symbols and Terms (<https://catalog.csuchico.edu/academic-standards-policies/course-description-symbols-terms/>) for an explanation of course description terminology and symbols, the course numbering system, and course credit units.

CIVL 101 Introduction to Civil Engineering 1 Unit

Typically Offered: Fall only

Introduction to the profession of Civil Engineering and the various sub-disciplines of Civil Engineering. Overview of the professional engineer licensing process. Overview of the CSU, Chico Civil Engineering curriculum and the disciplinary patterns in the curriculum. Discussion of the importance and purpose of both professional societies and graduate education. 3 hours laboratory. (021141)

Grade Basis: Credit/No Credit

Repeatability: You may take this course for a maximum of 1 unit

Course Attributes: Lower Division

CIVL 130 Surveying 3 Units

Prerequisite: MATH 120 (may be taken concurrently).

Typically Offered: Fall only

Theory and practice in measurement and computation of distances, angles, and areas on the earth's surface. Error of combined measurements analysis. Use of scientific calculator required. 2 hours discussion, 3 hours laboratory. (001484)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units

Course Attributes: Lower Division

CIVL 140 Transportation Planning, Surveying, and Graphics 3 Units

Prerequisite: CIVL 130.

Typically Offered: Spring only

This course introduces civil engineering design standards, concepts, and procedures related to transportation engineering and construction management. Topics include the standards and design of horizontal curves, vertical curves, and earthwork related to transportation projects in addition to survey staking, state plane coordinates, geographic information systems, and global positioning systems related to project surveying. The laboratory portion of this course includes the application of 3-dimensional graphic modeling software requiring creativity in design, development of construction plans, and operation of modern surveying equipment, such as total stations and GPS systems. 2 hours discussion, 3 hours laboratory. (021126)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units

Course Attributes: Lower Division

CIVL 175 Biological Processes in Environmental Engineering 3 Units

Prerequisite: High school biology and chemistry.

Typically Offered: Fall and spring

Introduction to biological processes used in environmental engineering analysis and design with emphasis on sustainability. Ecosystem structure and function, population dynamics, biochemical reactions, photosynthesis, microbial ecology, growth and kinetics. Engineering applications in control of communicable disease, aerobic and anaerobic degradation of organic waste, water quality management, drinking water treatment, wastewater and solid waste treatment, biomass energy, phytotechnology, and bioremediation. 2 hours activity, 2 hours lecture. (021145)

General Education: Laboratory Activity (B3); Life Science (B2)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units

Course Attributes: Lower Division; Sustainable Course

CIVL 198 Special Topics 1-3 Units

Typically Offered: Fall and spring

This course is for special topics offered for 1.0-3.0 units. Typically the topic is offered on a one-time-only basis and may vary from term to term and be different for different sections. 3 hours lecture. (001490)

Grade Basis: Graded

Repeatability: You may take this course more than once

Course Attributes: Lower Division

CIVL 199 Special Problems 1-3 Units

Prerequisite: Faculty permission.

Typically Offered: Fall and spring

This course is an independent study of special problems offered for 1.0-3.0 units. You must register directly with a supervising faculty member. 9 hours supervision. (020902)

Grade Basis: Credit/No Credit

Repeatability: You may take this course for a maximum of 6 units

Course Attributes: Lower Division

CIVL 205 Civil Engineering Computing 2 Units

Prerequisite: PHYS 204A (may be taken concurrently).

Typically Offered: Fall and spring

Applications of spreadsheets, python programming, and spatial analysis via geographical informational systems (GIS) to civil engineering problems. 4 hours activity. (001488)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 2 units

Course Attributes: Lower Division; Laptop required

CIVL 211 Statics 3 Units

Prerequisite: MATH 121, PHYS 204A.

Typically Offered: Fall and spring

Force systems, moments, equilibrium, centroids, and moments of inertia. 2 hours activity, 2 hours discussion. (001489)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units

Course Attributes: Lower Division

CIVL 212 Civil Engineering Materials**3 Units****Prerequisite:** CHEM 111.**Typically Offered:** Fall and spring

The goal of this course is for you to develop an understanding of several types of material behaviors, with emphasis on materials commonly used in the civil engineering profession. Materials studied include wood, steel, concrete, soil, and asphalt paving materials. Technical writing and report formatting are emphasized as well. 2 hours activity, 2 hours lecture. (021735)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Lower Division**CIVL 231 Introduction to Environmental Engineering****3 Units****Prerequisite:** CHEM 111, CIVL 175 (may be taken concurrently).**Typically Offered:** Fall and spring

Introduction to environmental engineering and sustainability. Topics covered include: global and local environmental issues; UN's sustainable development goals; engineering in developing communities; life cycle assessment; material and energy balances; pollutant fate and transport; principles of green engineering; and environmental engineering pathways. 3 hours lecture. (021736)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Lower Division; Sustainable Course; Laptop required**CIVL 302W Engineering Sustainability and Economic Analysis****(W)****3 Units W****Prerequisite:** GE Written Communication (A2) requirement; MATH 105 and MATH 119, or MATH 121; Junior standing.**Typically Offered:** Fall and spring

This course provides a foundation for green engineering design through life cycle assessment and life cycle cost analysis considering economically viable, socially just, and environmentally sustainable solutions (triple bottom line). This course teaches quantitative environmental and economic assessment tools, decision-making strategies, risk, sensitivity analysis, and uncertainty analysis. These skills are applied to real-world problems through group projects, emphasizing applied engineering, critical thinking, communication skills and teamwork. 3 hours discussion. (001495)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Upper Division; Sustainable Course; Laptop required; Writing Course**CIVL 311 Strength of Materials****4 Units****Prerequisite:** CIVL 211 with a grade of C- or higher; MATH 260 (may be taken concurrently); CIVL 212 or MECH 210 (may be taken concurrently).**Typically Offered:** Fall and spring

Strength and elastic properties of materials of construction; tension, compression, shear, and torsion stresses; deflection and deformation; stress analysis of beams and columns. 4 hours discussion. (001491)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 4 units**Course Attributes:** Upper Division**CIVL 313 Structural Mechanics****3 Units****Prerequisite:** CIVL 311 with a grade of C- or higher; CIVL 205 (may be taken concurrently) or MECH 208 (may be taken concurrently).**Typically Offered:** Fall and spring

Fundamentals of structural analysis for beams, trusses, and frames. Topics include loading (including seismic), influence lines, approximate analysis methods, deflection analysis, and statically indeterminate structures. Methods applicable to computer analysis are introduced. 3 hours discussion. (001499)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Upper Division; Laptop required**CIVL 321 Fluid Mechanics****4 Units****Prerequisite:** CIVL 211 with a grade of C- or higher. Recommended: MATH 260, MECH 320 (may be taken concurrently).**Typically Offered:** Fall and spring

Hydrostatics, principles of continuity, work-energy and momentum, viscous effects, dimensional analysis and similitude, flow in closed conduits, drag on objects. 3 hours discussion, 3 hours laboratory. (001496)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 4 units**Course Attributes:** Upper Division**CIVL 331 Environmental Engineering Chemistry****3 Units****Prerequisite:** CIVL 231.**Typically Offered:** Fall only

Chemical principles applicable to the analysis of natural and engineered water systems including acid base chemistry, precipitation and dissolution, oxidation-reduction, adsorption-desorption, and complexation. 2 hours activity, 2 hours lecture. (021737)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Upper Division; Sustainable Course; Laptop required**CIVL 389 Internship in Civil Engr****1-3 Units****Prerequisite:** Approval of supervising faculty member prior to off-campus assignment.**Typically Offered:** Fall and spring

This course is an internship offered for 1.0-3.0 units. You must register directly with a supervising faculty member. This program is designed for students who wish to gain practical work experience with participating civil engineering firms/organizations. 3 hours lecture. (001504)

Grade Basis: Credit/No Credit**Repeatability:** You may take this course for a maximum of 15 units**Course Attributes:** Upper Division**CIVL 389M Summer Internship in Civil Engineering****1-3 Units****Prerequisite:** Approval of supervising faculty member prior to off-campus assignment.**Typically Offered:** Summer session only

This course is an internship offered for 1.0 - 3.0 units. You must register directly with a supervising faculty member. This program is designed for students who wish to gain practical work experience with participating civil engineering firms/organizations. 0 hours supervision. (021287)

Grade Basis: Credit/No Credit**Repeatability:** You may take this course for a maximum of 15 units**Course Attributes:** Upper Division

- CIVL 398 Special Topics** 1-3 Units
Typically Offered: Fall and spring
 This course is for special topics offered for 1.0-3.0 units. Typically the topic is offered on a one-time-only basis and may vary from term to term and be different for different sections. See the Class Schedule for the specific topic being offered. 0 hours lecture. (001505)
Grade Basis: Graded
Repeatability: You may take this course more than once
Course Attributes: Upper Division
- CIVL 399 Special Problems** 1-3 Units
Prerequisite: Faculty permission.
Typically Offered: Fall and spring
 This course is an independent study of special problems offered for 1.0-3.0 units. You must register directly with a supervising faculty member. 9 hours supervision. (001506)
Grade Basis: Credit/No Credit
Repeatability: You may take this course for a maximum of 6 units
Course Attributes: Upper Division
- CIVL 411 Soil Mechanics and Foundations** 4 Units
Prerequisite: GE Written Communication (A2) requirement; CIVL 321 (may be taken concurrently).
Typically Offered: Spring only
 Soil properties, tests, and classification. Analysis of soil stresses, consolidation, shear strength, lateral pressures, and ground water movement. Related design consideration involving spread footings, piles, retaining walls, and slopes. Use of programmable scientific calculator required. 3 hours discussion, 3 hours laboratory. (001511)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division
- CIVL 413 Advanced Structures** 3 Units
Prerequisite: CIVL 313.
Typically Offered: Spring only
 Application of the material from CIVL 313 to advanced topics in structural analysis, including virtual work, second-order effects, the stiffness method, structural dynamics, and modal analysis. Use of computer software for the analysis of both two-dimensional and three-dimensional structural systems. Investigation of selected topics. 3 hours lecture. (021738)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division; Laptop required
- CIVL 415 Reinforced Concrete Design** 4 Units
Prerequisite: CIVL 313. Recommended: CIVL 411.
Typically Offered: Fall only
 The analysis and design of reinforced concrete structures and elements by the strength design method. Laboratory includes experiments on concrete, concrete structural elements, and a design project. 3 hours discussion, 3 hours laboratory. (001514)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division
- CIVL 431 Water and Wastewater Engineering** 4 Units
Prerequisite: CIVL 231 or faculty permission; junior standing.
Typically Offered: Spring only
 Introduction to water quality, water supply, distribution, and drinking water treatment; wastewater collection, treatment, and disposal. Disease transmission; water quality parameters; physical, chemical, and biological processes in the treatment of water, wastewater, and biosolids. 3 hours discussion, 3 hours laboratory. (001529)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division; Sustainable Course; Laptop required
- CIVL 441 Transportation Engineering** 4 Units
Prerequisite: CIVL 140; CIVL 302W (may be taken concurrently).
Typically Offered: Fall only
 Transportation systems and facility planning, design, construction, operations, and maintenance. Pavement design and traffic engineering fundamentals. Laboratory includes field studies, design exercises, and modeling/forecasting tasks. 3 hours discussion, 3 hours laboratory. (001520)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division; Sustainable Course
- CIVL 461 Water Resources Engineering** 3 Units
Prerequisite: CIVL 205 or MECH 208; CIVL 321 with a grade of C- or higher.
Typically Offered: Spring only
 Water resources engineering covers principles of hydraulics and hydrology relevant to civil engineering applications. Topics include open channel hydraulics, rainfall-runoff predictions, ground water hydraulics, water budget modeling, storm water routing, and urban storm water management. 2 hours activity, 2 hours discussion. (021142)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division; Sustainable Course; Laptop required
- CIVL 495 Professional Issues in Engineering** 3 Units
Prerequisite: GE Written Communication (A2) requirement; senior standing.
Typically Offered: Fall and spring
 History of engineering, professional registration, codes of ethics, management issues, diversity, outsourcing, intellectual property, international development and technology transfer, sustainable design. A substantial written project with oral presentation is required. 2 hours activity, 2 hours discussion. (003716)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division
- CIVL 498 Advanced Topics** 1-3 Units
Prerequisite: To be established when courses are formulated.
Typically Offered: Fall and spring
 This course is for special topics offered for 1.0-3.0 units. Typically the topic is offered on a one-time-only basis and may vary from term to term and be different for different sections. See The Class Schedule for the specific topic being offered. 3 hours lecture. (001537)
Grade Basis: Graded
Repeatability: You may take this course more than once
Course Attributes: Upper Division

<p>CIVL 499 Special Problems 1-3 Units Prerequisite: Faculty permission. Typically Offered: Fall and spring This course is an independent study of special problems offered for 1.0-3.0 units. You must register directly with a supervising faculty member. 3 hours supervision. (001539) Grade Basis: Credit/No Credit Repeatability: You may take this course for a maximum of 6 units Course Attributes: Upper Division</p>	<p>CIVL 556H Timber Design - Honors 3 Units Prerequisite: CIVL 313. Typically Offered: Inquire at department Theory and design procedures for timber structures and their connections to resist gravity and lateral loads. Basic element design by the Allowable Stress Design (ASD) and/or Load and Resistance Factor Design (LRFD) methods are detailed. Also covered is design of floor and roof systems and shear walls. One or two 3-hour field trips required. 3 hours discussion. (020404) Grade Basis: Graded Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division</p>
<p>CIVL 499H Honors Project 3 Units Prerequisite: Completion of 12 units of upper-division C E courses, faculty permission. Typically Offered: Inquire at department This course may be taken twice for a maximum of 6 units. Prerequisite to the second semester is a B or higher in the first semester. Open by invitation to C E majors who have a GPA among the top 5% of C E students based upon courses taken at CSU, Chico. This is an "Honors in the Major" course; a grade of B or higher in 6 units of 499H certifies the designation of "Honors in the Major" to be printed on the transcript and the diploma. Each 3-unit course will require both formal written and oral presentations. 9 hours supervision. (001540) Grade Basis: Graded Repeatability: You may take this course for a maximum of 6 units Course Attributes: Upper Division</p>	<p>CIVL 558 Earthquake and Wind Engineering 3 Units Prerequisite: CIVL 415, CIVL 554, or CIVL 556. Typically Offered: Inquire at department Earthquake and wind hazard related to the structural design of buildings. Topics include engineering seismology, wind environment and climatology, structural dynamics, structural loading, and design methodologies. Use of computer software for the static and dynamic analysis of three-dimensional building systems. 2 hours activity, 2 hours discussion. (001518) Grade Basis: Graded Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division; Laptop required</p>
<p>CIVL 551 Foundations Engineering 3 Units Prerequisite: CIVL 411, CIVL 415 (may be taken concurrently). Typically Offered: Inquire at department The application of soil mechanics principles to the design of foundations for buildings and earth structures. Integration of structural design and soil response. 3 hours discussion. (001513) Grade Basis: Graded Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division</p>	<p>CIVL 558C Earthquake and Wind Engineering - Capstone 3 Units Prerequisite: CIVL 415, CIVL 554, or CIVL 556. Corequisites: CIVL 595W. Typically Offered: Inquire at department Earthquake and wind hazard related to the structural design of buildings. Topics include engineering seismology, wind environment and climatology, structural dynamics, structural loading, and design methodologies. Use of computer software for the static and dynamic analysis of three-dimensional building systems. 2 hours activity, 2 hours discussion. (021175) Grade Basis: Graded Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division; Laptop required</p>
<p>CIVL 554 Steel Design 3 Units Prerequisite: CIVL 313. Typically Offered: Inquire at department Theory, analysis, and design of steel structural elements and systems using the Load and Resistance Factor Design (LRFD) method. 3 hours discussion. (001500) Grade Basis: Graded Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division; Laptop required</p>	<p>CIVL 558H Earthquake and Wind Engineering - Honors 3 Units Prerequisite: CIVL 313, MATH 260. Recommended: Concurrent enrollment in or prior completion of CIVL 415, CIVL 554, CIVL 556. Typically Offered: Inquire at department Earthquake and wind hazard related to the structural design of buildings. Topics include engineering seismology, wind environment and climatology, structural dynamics, structural loading, and design methodologies. Use of computer software for the static and dynamic analysis of three-dimensional building systems. 2 hours activity, 2 hours discussion. (020405) Grade Basis: Graded Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division</p>
<p>CIVL 556 Timber Design 3 Units Prerequisite: CIVL 313. Typically Offered: Inquire at department Theory and design procedures for timber structures and their connections to resist gravity and lateral loads. Basic element design by the Allowable Stress Design (ASD) and/or Load and Resistance Factor Design (LRFD) methods are detailed. Also covered is design of floor and roof systems and shear walls. One or two 3-hour field trips required. 3 hours discussion. (001516) Grade Basis: Graded Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division</p>	<p>CIVL 561 Hydrology and Open Channels Hydraulics  3 Units Prerequisite: CIVL 461. Typically Offered: Inquire at department Principles and applications of modern hydrology, precipitation, surface-water runoff, and open channel hydraulics. Includes topics in urban hydrology, stormwater controls and pollution controls. 2 hours activity, 2 hours discussion. (001526) Grade Basis: Graded Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division; Sustainable Course; Laptop required</p>

CIVL 561C Hydrology and Open Channel Hydraulics**Capstone** **3 Units****Prerequisite:** CIVL 461.**Corequisites:** CIVL 595W.**Typically Offered:** Fall and spring

Principles and application of modern hydrology, precipitation, surface-water runoff, and open channel hydraulics. Includes topics in urban hydrology, stormwater controls, and pollution controls. 2 hours activity, 2 hours discussion. (021246)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Upper Division; Sustainable Course; Laptop required**CIVL 562 Groundwater Hydrology** **3 Units****Prerequisite:** CIVL 461.**Typically Offered:** Inquire at department

An introduction to modern groundwater hydrology emphasizing quantitative analysis of subsurface flow. Topics include well hydraulics, stream/aquifer interactions, and contaminant transport. Use of modeling tools and techniques is emphasized. 2 hours activity, 2 hours discussion. (001498)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Upper Division; Sustainable Course; Laptop required**CIVL 562C Groundwater Hydrology - Capstone** **3 Units****Prerequisite:** CIVL 461.**Corequisites:** CIVL 595W.**Typically Offered:** Inquire at department

An introduction to modern groundwater hydrology emphasizing quantitative analysis of subsurface flow. Topics include well hydraulics, stream/aquifer interactions, and contaminant transport. Use of modeling tools and techniques is emphasized. 2 hours activity, 2 hours discussion. (021177)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Upper Division; Sustainable Course**CIVL 564 Spatial Hydrology****3 Units****Prerequisite:** CIVL 461; EARTH 380 for EARTH majors.**Typically Offered:** Inquire at department

This course builds on aspects of the rapidly emerging field of spatial hydrology, GIS, and Python introduced during earlier coursework. As spatially explicit remotely sensed and numerically modeled hydrology and climate datasets continue to increase, students need new tools to manage, analyze, and visualize them. This course focuses on applying two core tools already introduced to students in earlier classes (i.e. geographic information systems (GIS) and Python) to a culminating capstone project focused on managing, analyzing, and visualizing how real-world hydrology and climate data sets are changing in space and time. 2 hours activity, 2 hours lecture. (022207)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Upper Division; Laptop required**CIVL 564C Spatial Hydrology - Capstone****3 Units****Prerequisite:** CIVL 461; EARTH 380 for EARTH majors.**Corequisites:** CIVL 595W.**Typically Offered:** Inquire at department

This course builds on aspects of the rapidly emerging field of spatial hydrology, GIS, and Python introduced during earlier coursework. As spatially explicit remotely sensed and numerically modeled hydrology and climate datasets continue to increase, students need new tools to manage, analyze, and visualize them. This course focuses on applying two core tools already introduced to students in earlier classes (i.e. geographic information systems (GIS) and Python) to a culminating capstone project focused on managing, analyzing, and visualizing how real-world hydrology and climate data sets are changing in space and time. 2 hours activity, 2 hours lecture. (022208)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Upper Division; Laptop required**CIVL 567 Pipeline Hydraulics and Design****3 Units****Prerequisite:** CIVL 302W, CIVL 461.**Typically Offered:** Inquire at department

Quantitative analysis of pressurized pipelines, pipe networks. The course includes analysis of transients in pipeline systems caused by valve movement, pump power failure, etc; design of transient control devices. 3 hours discussion. (001528)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Upper Division; Laptop required**CIVL 571 Natural Systems for Wastewater Treatment** **3 Units****Prerequisite:** CIVL 431 or faculty permission.**Typically Offered:** Inquire at department

Natural systems for the treatment of wastewater; transmission of excreta-related infections; treatment systems for removal of pathogens; wastewater and biosolids reuse in agriculture and aquaculture. Special emphasis on the problems of developing countries. 2 hours activity, 2 hours discussion. (001533)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Upper Division; Sustainable Course**CIVL 571C Natural Systems for Wastewater Treatment - Capstone** **3 Units****Prerequisite:** CIVL 431.**Corequisites:** CIVL 595W.**Typically Offered:** Inquire at department

Natural systems for the treatment of wastewater; transmission of excreta-related infections; treatment systems for removal of pathogens; wastewater and biosolids reuse in agriculture and aquaculture. Special emphasis on the problems of developing countries. 2 hours activity, 2 hours discussion. (021241)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Upper Division; Sustainable Course; Laptop required

CIVL 573 Water Quality and Contaminant Transport  **3 Units****Prerequisite:** CIVL 231 or CIVL 431.**Typically Offered:** Inquire at department

This course introduces and develops fundamental chemical concepts that explain pollutant fate and transport in soil, water, and air. In addition to chemical concepts, students learn how to develop and apply remediation strategies based on contaminant behavior. Remedial system design addresses topics such as acid mine drainage, organic solvent contaminated groundwater, crude oil in surface water, and other areas of student interest. 3 hours discussion. (001535)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Upper Division; Sustainable Course; Laptop required**CIVL 575 Solid and Hazardous Waste Management**  **3 Units****Prerequisite:** CIVL 431 or faculty permission.**Typically Offered:** Inquire at department

An introduction to the handling and management of solid and hazardous wastes. Emphasis on state-of-the-art engineering techniques and contemporary management issues based on social, economic, and legal considerations; risk assessment; case studies. Special emphasis on problems of developing countries. 3 hours discussion. (001536)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Upper Division; Sustainable Course**CIVL 575C Solid and Hazardous Waste Management - Capstone**  **3 Units****Prerequisite:** CIVL 431 or faculty permission.**Corequisites:** CIVL 595W.**Typically Offered:** Inquire at department

An introduction to the handling and management of solid and hazardous wastes. Emphasis on state-of-the-art engineering techniques and contemporary management issues based on social, economic, and legal considerations; risk assessment; case studies. Special emphasis on problems of developing countries. 2 hours activity, 2 hours discussion. (021326)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Upper Division; Sustainable Course**CIVL 586 Advanced Transportation Engineering Design** **3 Units****Prerequisite:** CIVL 441.**Typically Offered:** Spring only

This course presents selected topics in advanced transportation engineering techniques, design, and analysis. These topics cover the advanced technologies in the areas of transportation pavements, transportation materials, traffic engineering, and travel demand modeling. The course is also designed to equip students with practical design oriented experience with comprehensive knowledge learned through previous transportation related classes. 2 hours activity, 2 hours discussion. (021248)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Upper Division; Laptop required**CIVL 586C Advanced Transportation Engineering Design - Capstone** **3 Units****Prerequisite:** CIVL 441.**Corequisites:** CIVL 595W.**Typically Offered:** Spring only

This course presents selected topics in advanced transportation engineering techniques, design, and analysis. These topics cover the advanced technologies in the areas of transportation pavements, transportation materials, traffic engineering, and travel demand modeling. The course is also designed to equip students with practical design oriented experience with comprehensive knowledge learned through previous transportation related courses. 2 hours activity, 2 hours discussion. (021261)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Upper Division; Laptop required**CIVL 592 Construction Engineering and Management** **3 Units****Prerequisite:** CIVL 302W (may be taken concurrently), CIVL 411.**Typically Offered:** Inquire at department

Introduction to construction engineering and management. Cost estimation for contract construction and engineering, including labor, material, equipment, and overhead costs. Construction procedures, equipment and methods; efficient use of excavation and hauling equipment operations. Application of crew balance, process chart and operations research techniques to construction operations. Planning, scheduling, and progress controls of construction operations. One or two three-hour field trips may be required. 3 hours discussion. (001510)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Upper Division**CIVL 595W Capstone Design Project (W)** **3 Units W, GW****Prerequisite:** GE Oral Communication (A1) requirement, GE Written Communication (A2) requirement; Junior standing.**Corequisites:** CIVL 558C, CIVL 561C, CIVL 562C, CIVL 564C, CIVL 571C, CIVL 575C, or CIVL 586C.**Typically Offered:** Fall and spring

This course provides a broad-based capstone design experience in a coordinated semester long project. In support of the design project, emphasis is placed on fundamentals of technical writing, contracts, and specifications common to many fields of civil engineering. 3 hours discussion. (021174)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Upper Division; Writing Course; Graduation Writing Assessment**CIVL 598 Advanced Special Topics** **1-3 Units****Prerequisite:** To be established when courses are formulated.**Typically Offered:** Fall and spring

This course is for special topics offered for 1.0-3.0 units. Typically the topic is offered on a one-time-only basis and may vary from term to term and be different for different sections. See The Class Schedule for the specific topic being offered. 3 hours lecture. (020084)

Grade Basis: Graded**Repeatability:** You may take this course more than once**Course Attributes:** Upper Division

CIVL 599 Special Problems**1-3 Units****Prerequisite:** Faculty permission.**Typically Offered:** Inquire at department

This course is an independent study of special problems offered for 1.0-3.0 units. You must register directly with a supervising faculty member. 0 hours supervision. (020171)

Grade Basis: Graded**Repeatability:** You may take this course for a maximum of 6 units**Course Attributes:** Upper Division; Laptop required**CIVL 682 Introduction to Pavement Preservation****3 Units****Prerequisite:** Bachelor's Degree or faculty permission.**Typically Offered:** Inquire at department

An overview of terms related to pavement management systems and their use in identifying both functional and structural distresses in flexible and rigid pavement and their role in pavement preservation strategies. 3 hours lecture. (020773)

Grade Basis: Graduate Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Graduate Division; Sustainable Course**CIVL 684 Rigid Pavement Preservation****3 Units****Prerequisite:** CIVL 682 or faculty permission.**Typically Offered:** Inquire at department

Rigid pavement distress causes and measurements; project selection for preservation methods; construction best practices for preservation, maintenance, and rehabilitation processes. 3 hours lecture. (020775)

Grade Basis: Graduate Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Graduate Division; Sustainable Course**CIVL 697 Independent Study****1-3 Units****Prerequisite:** Faculty permission.**Typically Offered:** Fall and spring

This course is a graduate-level independent study offered for 1.0-3.0 units. You must register directly with a supervising faculty member. 9 hours supervision. (001551)

Grade Basis: Report in Progress: Graded**Repeatability:** You may take this course for a maximum of 6 units**Course Attributes:** Graduate Division**CIVL 698 Special Topics****1-3 Units****Prerequisite:** Department permission.**Typically Offered:** Fall and spring

This course is for special topics offered for 1.0-3.0 units. Typically the topic is offered on a one-time-only basis and may vary from term to term and be different for different sections. See the Class Schedule for the specific topic being offered. 3 hours lecture. (001550)

Grade Basis: Graduate Graded**Repeatability:** You may take this course for a maximum of 3 units**Course Attributes:** Graduate Division**CIVL 699P Master's Project****1-6 Units****Prerequisite:** See the department secretary.**Typically Offered:** Fall and spring

This course is offered for 1.0-6.0. You must register directly with a supervising faculty member. 3 hours supervision. (001558)

Grade Basis: Report in Progress: CR/NC**Repeatability:** You may take this course for a maximum of 6 units**Course Attributes:** Graduate Division**CIVL 699T Master's Thesis****1-6 Units****Prerequisite:** Faculty permission.**Typically Offered:** Fall and spring

This course is a master's study offered as either a Master's Thesis or as a Master's Project for 1.0-6.0 units. You must register directly with a supervising faculty member. 3 hours supervision. (001555)

Grade Basis: Report in Progress: CR/NC**Repeatability:** You may take this course for a maximum of 6 units**Course Attributes:** Graduate Division