

# Civil Engineering

IN THE COLLEGE OF ENGINEERING

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The undergraduate degree in Civil Engineering is accredited by the Engineering Accreditation Commission (EAC) of ABET, <http://www.abet.org>.

## Faculty

**Emeritus:** Banks, Buyuksonmez, Chang, Chou, Gurol, Hayhurst, Johnson, Krishnamoorthy, McGhie, Noorany, Ponce, Sharabi, Westermo

**Chair:** Supernak

**The AGC Paul S. Roel Chair in Construction Engineering and Management:** Alves

**The William E. Leonhard, Jr. Chair in Civil, Construction, and Environmental Engineering:** Mladenov

**Professors:** Bayasi, Garoma Ararso, Supernak, Valdes

**Associate Professors:** Alves, Dowell, Kinoshita, Mitropoulos, Mladenov

**Assistant Professors:** Akhavian, Dykstra, Ghanipoor Machiani, Jahangiri, Miletic, Tavakol-Davani, Verbyla

**Offered by the Department of Civil, Construction, and Environmental Engineering**

Doctor of Philosophy degree in engineering sciences: (bioengineering), (electrical and computer engineering), (mechanical and aerospace engineering), (structural engineering).

Master of Engineering.

Master of Science degree in civil engineering.

Concentration in environmental engineering.

Major in civil engineering with the B.S. degree.

Major in construction engineering with the B.S. degree.

Major in environmental engineering with the B.S. degree.

## The Associated General Contractors (AGC) Paul S. Roel Chair in Construction Engineering and Management

The AGC Paul S. Roel Chair in Construction Engineering and Management is funded with an endowment established by generous gifts from members of the Associated General Contractors in San Diego Chapter. Recognizing the need for expert construction professionals, the local construction community has invested considerable resources in this new degree program. In particular, the endowment is funded by a significant gift from Roel Construction, in honor of Paul S. Roel, the son of the company's founder and the man responsible for moving the family business to San Diego in 1959. The current appointee to the chair, Dr. Thais da Costa Alves, has been teaching and advising students, researching, and collaborating with construction companies toward the dissemination and implementation of lean, especially in the field of production planning and control at construction sites.

## The William E. Leonhard, Jr. Chair in Civil, Construction, and Environmental Engineering

The William E. Leonhard, Jr. Chair in Civil, Construction, and Environmental Engineering is funded with an endowment created by generous gifts from William G. Leonhard, Jr. and his parents, William E. and Wyllis M. Leonhard. After Bill Leonhard graduated from San Diego State in 1964, he entered a career in the Air Force, rising to the rank of colonel. In January 1990, he retired from the Air Force, spent the next several years in private industry, and retired again in 1998.

The current chair, Dr. Natalie Mladenov, promotes excellence in undergraduate education, research in environmental engineering, and conducts scholarly activities on the topic of water quality in environmental engineering.

## Mission of the Department

The mission of the Department of Civil, Construction, and Environmental Engineering is to ensure student success by providing a high-quality education through focused instruction, research, and continuing professional development for the benefit of the engineering profession, the environment, and society.

The objective of the program is to give the student a basic knowledge of civil, construction, and environmental engineering, as well as the interdisciplinary background and skills to meaningfully participate in and contribute technical advances toward this profession. The program integrates technical aspects with studies in the social sciences and humanities to ensure appropriate sensitivity to socially related problems.

Instruction is given both at the undergraduate level, leading to the bachelor's degree, and at the graduate level, leading to the master's or doctoral degrees. The undergraduate program builds upon concepts of mathematics, physics, chemistry and basic engineering with specialized study in civil, construction, and environmental engineering. Engineering design is emphasized, particularly in conjunction with computer utilization and practical engineering problems. Aspects of safety and engineering ethics are woven throughout the program. Breadth and depth of social science and humanities studies is assured by department approved courses. Completion of the under-graduate degree prepares the student for an entry-level professional position in addition to informal or formal graduate studies.

Many students who complete the undergraduate programs of the department choose to continue their formal studies on a full- or part-time basis at San Diego State University or at another institution. (See the *Graduate Bulletin* for additional information.)

The civil, construction, and environmental engineering programs are enhanced through cooperation with the American Society of Civil Engineers, the American Public Works Association, the Associated General Contractors, the Chi Epsilon Civil Engineering Honor Society, and other national organizations who sponsor student chapters to further aid the student's professional development. The chapters at San Diego State University have won many awards in regional and national competition with other schools throughout the country.

## Program Educational Objectives

Graduates of the civil engineering program will (1) be successful engineers in their respective fields of work; (2) be continually progressing in their chosen careers through formal and informal professional development; and (3) be contributing to their profession for the betterment of society and the environment.

## Transfer Credit

No credit will be given for upper division engineering coursework taken at an institution having an engineering program which has not been accredited by the Engineering Accreditation Commission (EAC) of ABET, unless the student successfully completes the first 12 units of engineering work attempted at this university. At that time, and upon recommendation of the department, unaccredited work will be evaluated for full or partial credit.

## The Major

Civil engineering is the application of engineering principles to the improvement of the human environment. The civil engineering major prepares students to design and supervise the construction of buildings, dams, roads, harbors, airports, tunnels, and

bridges. It also provides training in the planning and construction of the complex systems that supply clean water to cities, remove sewage, control floods, and perform other functions which ensure continued health and safety.

Civil engineers are needed in both the private and public sectors. They are employed in the aerospace industry, usually as structural engineers; design and construction of roads, buildings, bridges, airports, dams and other structures; research and teaching at colleges and universities (with an advanced degree); public utilities and transportation; manufacturing; and offshore drilling, environmental pollution, and energy self-sufficiency. New job opportunities in civil engineering will result from growing demands in housing, industrial buildings, power generating plants, and transportation systems.

### Retention Policy

The engineering program expects all majors will make reasonable academic progress toward the degree. Engineering pre-majors who have either (1) completed major preparatory courses, earned 60 units, but have less than a 2.7 cumulative GPA or (2) earned 60 units but have not completed major preparatory courses and/or have less than a 2.7 cumulative GPA may be removed from the premajor and placed in undeclared.

### Impacted Program

The civil engineering major is an impacted program. To be admitted to the civil engineering major, students must meet the following criteria:

- Complete with a grade of C (2.0) or better: Civil Engineering 225; Chemistry 202 (or 200); Mathematics 150, 151; Physics 195, 196. These courses cannot be taken for credit/no credit (Cr/NC);
- Have an overall cumulative GPA of 2.7.

To complete the major, students must fulfill the degree requirements for the major described in the catalog in effect at the time they are accepted into the premajor at SDSU (assuming continuous enrollment).

### Major Academic Plans (MAPs)

Visit <http://www.sdsu.edu/mymap> for the recommended courses needed to fulfill your major requirements. The MAPs website was created to help students navigate the course requirements for their majors and to identify which General Education course will also fulfill a major preparation course requirement.

### Civil Engineering Major

With the B.S. Degree

(Major Code: 09081) (SIMS Code: 442001)

This program requires 135 units to include general education. In addition, the total number of units specified in each elective category represents the minimum requirement.

**Preparation for the Major.** Civil Engineering 100, 121, 160 (or Statistics 250), 218, 220, 225; Aerospace Engineering 280; Biology 100 or 101; Chemistry 202 (or 200); Construction Engineering 101; Mathematics 150, 151, 252; Physics 195, 195L, 196. (48 units)

Civil Engineering 225; Chemistry 202 (or 200); Mathematics 150, 151; Physics 195, 196 must be completed with a grade of C (2.0) or better. These courses cannot be taken for credit/no credit (Cr/NC).

**Engineering Science Elective.** Select at least one of the following courses: Electrical Engineering 204; Mechanical Engineering 240, 350.

**Graduation Writing Assessment Requirement.** Passing the Writing Placement Assessment with a score of 10 or completing one of the approved upper division writing courses (W) with a grade of C (2.0) or better. See "Graduation Requirements" section for a complete listing of requirements.

**Major.** A minimum of 48 upper division units to include the following required and elective courses. Required upper division courses in the major: Civil Engineering 301 (or Mechanical Engineering 304), 302, 321, 401, 421, 444, 462, 463, 481, 495; Aerospace Engineering 340; Construction Engineering 330; Environmental Engineering 355.

Professional Electives. 15 units of elective credit. Course choices must consist of at least one course from at least four of the six areas to include ten units of designated design courses.

**Water** – Civil Engineering 445, 530.

**Transportation** – Civil Engineering 482, 580.

**Environmental** – Environmental Engineering 363\*, 445, 556, 558.

**Structural** – Civil Engineering 521\*, 523, 525, 528.

**Geotechnical** – Civil Engineering 465.

**Construction** – Construction Engineering 401, 479, 480, 520.

\*No design component.

**Master Plan.** A master plan of elective courses must be approved by the undergraduate adviser as soon as the civil engineering major is declared. Students are required to see their undergraduate adviser prior to registration each semester.

### Courses (CIV E)

Refer to *Courses and Curricula and University Policies* sections of this catalog for explanation of the course numbering system, unit or credit hour, prerequisites, and related information.

### LOWER DIVISION COURSES

**NOTE:** Proof of completion of prerequisites (copy of transcript) is required for all courses which list prerequisites.

#### CIV E 100. Introduction to Civil Engineering (1)

Introduction to diverse field of civil and environmental engineering to include structural, geotechnical, water resources, transportation, construction engineering and management, and environmental engineering. Legal, ethical, and international dimensions of the profession.

#### CIV E 121. Computer Graphics for the Built Environment (3)

Two lectures and two hours of activity.

Computer aided design for civil engineering applications (AutoCAD).

#### CIV E 160. Statistical Methods for the Built Environment (3)

Prerequisite: Mathematics 141.

Application of statistical methods to civil and environmental engineering problems in construction, hydrology, water quality, air pollution, and other related areas. Students with credit or concurrent registration in the following lower division statistics courses will be awarded a total of four units for the two (or more) courses: Civil Engineering 160; Administration, Rehabilitation and Postsecondary Education 201; Biology 215; Economics 201; Linguistics 270; Political Science 201; Psychology 280; Sociology 201; Statistics 119, 250.

#### CIV E 218. Surveying for Civil Engineering and Construction (3)

Two lectures and three hours of laboratory.

Prerequisites: Mathematics 150 and for civil and construction engineering majors, Civil Engineering 160 or for construction management majors, Statistics 119.

Principles of plane surveying. Measurement of horizontal distance, difference in elevation, and angles. Traverse surveys and computations. Horizontal and vertical curves. Principles of stadia. Topographic surveys. Earthwork.

#### CIV E 220. Civil and Environmental Engineering Computer Applications (3)

Prerequisite: Mathematics 150.

Graphical information systems (GIS), specialized civil engineering software, advanced problem solving.

#### CIV E 225. Mechanics for Civil Engineers (3)

Prerequisites: Mathematics 150. For civil engineering, construction engineering, and environmental engineering majors: Physics 195. For construction management majors: Physics 180A. Open to majors in civil engineering, construction engineering, environmental engineering, and construction management.

Applied forces and reactions of simple structures, beams, and large structures such as bridges, buildings, and dams. Static equilibrium. Not open to students with credit in Mechanical Engineering 200 [or Aerospace Engineering 200] or Mechanical Engineering 220 [or Aerospace Engineering 220].

## Civil Engineering

### **CIV E 296. Experimental Topics (1-4)**

Selected topics. May be repeated with new content. See *Class Schedule* for specific content. Limit of nine units of any combination of 296, 496, 596 courses applicable to a bachelor's degree.

### **UPPER DIVISION COURSES**

(Intended for Undergraduates)

#### **CIV E 301. Introduction to Solid Mechanics (3)**

Prerequisite: Aerospace Engineering 200 [or Mechanical Engineering 200] or for civil, construction, environmental engineering, and construction management majors, Civil Engineering 225.

Mechanics of solid deformable bodies involving analytical methods for determining strength, stiffness, and stability of load-carrying members. Not open to students with credit in Mechanical Engineering 304.

#### **CIV E 302. Solid Mechanics Laboratory (1)**

Three hours of laboratory.

Prerequisite: Credit or concurrent registration in Civil Engineering 301 (or Mechanical Engineering 304).

Laboratory studies in solid mechanics. Experimental stress analysis. Experimental confirmation of theory.

#### **CIV E 321. Structural Analysis I (3)**

Prerequisites: Civil Engineering 301 (or Mechanical Engineering 304) and credit or concurrent registration in Civil Engineering 302. Approved upper division engineering major, minor, or another major approved by the College of Engineering. **Proof of completion of prerequisites required:** Change of major form or other evidence of acceptable major code.

Analysis of beams, frames, trusses, and three-dimensional frameworks. Influence lines; deflections; introduction to statically indeterminate structures and moment distribution.

#### **CIV E 401. Civil Engineering and Society (1)**

Prerequisite: Senior standing in civil engineering.

Role of civil engineers in society. Historical, political, esthetic, and philosophical perspectives on civil engineering. Contemporary issues involving civil engineering.

#### **CIV E 421. Reinforced Concrete Design (3)**

Prerequisite: Civil Engineering 321.

Properties and characteristics of reinforced concrete; design of structural components. Introduction to plastic theory and limit design.

#### **CIV E 444. Applied Hydraulics (3)**

Two lectures and three hours of laboratory.

Prerequisite: Aerospace Engineering 340.

Review of fluid statics. Forces on submerged surfaces. Close conduit flow. Pumps and turbines. Open-channel flow. Dams and reservoirs. Flood control.

#### **CIV E 445. Applied Hydrology (3)**

Two lectures and three hours of laboratory.

Prerequisite: Civil Engineering 444.

Basic hydrologic principles, hydrologic measurements, small and midsize catchment hydrology, frequency analysis, regional analysis, reservoir, stream channel and catchment routing, hydrologic design.

#### **CIV E 462. Geotechnical Engineering (3)**

Prerequisite: Civil Engineering 301 (or Mechanical Engineering 304) or Aerospace Engineering 340.

Mechanics of soils as they apply to engineering problems, soil classification, compaction, swelling, consolidation, strength and permeability. Applications to geotechnical and environmental engineering problems.

#### **CIV E 463. Geotechnical Engineering Laboratory (1)**

Three hours of laboratory.

Prerequisite: Credit or concurrent registration in Civil Engineering 462.

Laboratory procedures of soil testing for geotechnical and environmental engineering problems.

#### **CIV E 465. Foundation Engineering and Earth Retaining Structures (3)**

Prerequisite: Civil Engineering 462.

Soil mechanics theories applied to design of shallow and deep foundations; lateral pressure of soils, design of retaining walls.

#### **CIV E 481. Transportation Engineering (3)**

Prerequisites: Civil Engineering 160 and 218.

Physical design of transportation facilities, traffic analysis and control for different modes, planning and demand analysis, introduction to environmental impacts of transportation systems and intelligent transportation systems.

#### **CIV E 482. Highway Engineering (3)**

Two lectures and three hours of laboratory.

Prerequisite: Civil Engineering 481.

Highway design, facility sizing, geometric design, drainage, earthwork, pavement design, traffic control devices, safety and environmental considerations.

#### **CIV E 495. Capstone Design Project (3)**

One lecture and six hours of laboratory.

Prerequisites: For civil engineering majors: Credit or concurrent registration in Civil Engineering 321, 444, 462, 481, and Environmental Engineering 355. At least three of these courses must be completed prior to enrolling in this course. For environmental engineering majors: Construction Engineering 330 and credit or concurrent registration in Environmental Engineering 445, 554, 556, 558. At least three of these courses must be completed prior to enrolling in this course. For construction engineering majors, credit or concurrent registration in Construction Engineering 480 and 590.

Application of engineering principles and design techniques to the design of civil engineering projects.

#### **CIV E 496. Advanced Civil Engineering Topics (1-3)**

Prerequisite: Consent of instructor.

Modern developments in civil engineering. See *Class Schedule* for specific content. Maximum credit six units for any combination of Civil Engineering 496, 499 and 596.

#### **CIV E 499. Special Study (1-3) Cr/NC**

Prerequisite: Consent of instructor.

Individual study in the area of civil engineering. Maximum credit six units for any combination of Civil Engineering 496, 499 and 596.

### **UPPER DIVISION COURSES**

(Also Acceptable for Advanced Degrees)

#### **CIV E 521. Structural Analysis II (3)**

Prerequisite: Civil Engineering 321.

Analysis of statically indeterminate structures by virtual work. Advanced treatment of slope deflection, moment distribution. Arch analysis, secondary stresses in trusses. Advanced treatment of influence lines. Introduction to matrix analysis of structures.

#### **CIV E 523. Design of Light Framed Structures (3)**

Prerequisite: Civil Engineering 321.

Material properties for wood and metal studs. Loads and structural forces for buildings. Design of beams, columns, bearing stud walls. Seismic forces and lateral force resisting systems. Roof, floor, and shear wall design. Composite beams.

#### **CIV E 525. Design of Steel Structures (3)**

Prerequisite: Civil Engineering 321.

Mechanical behavior of structural steel. Design of steel beams, girders, columns and members subjected to combined stresses. Design of various types of connections of steel structures; plate girders, continuous beams and rigid frames.

#### **CIV E 528. Masonry Structures Design (3)**

Prerequisite: Civil Engineering 321.

Analysis and design of masonry beams, retaining walls, shear walls, bearing walls, and columns. Use of allowable stress and strength design methods. Design project, including structural system analysis and lateral design of masonry buildings.

**CIV E 530. Open Channel Hydraulics (3)**

Two lectures and three hours of laboratory.

Prerequisite: Civil Engineering 444.

Principles of open channel flow. Analysis and problems of critical, uniform, gradually-varied, and rapidly-varied flows. Flow over weirs and spillways. Bridge, culvert and multiple openings hydraulics and modeling. Channel transitions. Design and environmental problems. Workshops on river analysis system (HEC-RAS 4.0).

**CIV E 531. Pipe Flow and Water Distribution Systems (3)**

Prerequisite: Civil Engineering 444.

Principles of pressurized pipe flow. Estimation and management of water demand and water supply systems. Analysis of network distribution elements and network modeling. Design of distribution systems, their operation and maintenance, asset management, and financial appraisal.

**CIV E 545. Field Methods in Hydrology (3)**

Two lectures and two hours of laboratory.

Prerequisites: Civil Engineering 220 and 445 with a grade of C (2.0) or better. **Proof of completion of prerequisites required:** Copy of transcript.

Equipment, field methods, and techniques used to study hydrologic systems and water resources, to include local streams and watersheds in California. Tools provided to design and implement field studies and interpret data.

**CIV E 580. Traffic Engineering Design (3)**

Prerequisite: Civil Engineering 481.

Sizing and configuration of highway facilities based on capacity analysis. Traffic signal design, impact and mitigation studies, parking, safety design.

**CIV E 596. Advanced Civil Engineering Topics (1-3)**

Prerequisite: Consent of instructor.

Modern developments in civil engineering. May be repeated with new content. See *Class Schedule* for specific content. Maximum credit of six units for any combination of Civil Engineering 496, 499 and 596 applicable to a bachelor's degree. Credit for 596 and 696 applicable to a master's degree with approval of the graduate adviser.

For additional courses which are electives in the civil engineering program, refer to "Construction Engineering" and "Environmental Engineering" in this section of the catalog.

## GRADUATE COURSES

Refer to the *Graduate Bulletin*.