Civil, Construction, and Environmental Engineering

In the College of Engineering

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Faculty

Janusz C. Supernak, Ph.D., Professor of Civil, Construction, and Environmental Engineering, Chair of Department
M. Ziad Bayasi, Ph.D., P.E., Professor of Civil, Construction, and Environmental Engineering
Temesgen Garoma Ararsso, Ph.D., P.E., Professor of Civil, Construction, and Environmental Engineering, The Blasker Chair in Environmental Engineering, Interim Associate Dean for Graduate Studies and Research, College of Engineering
Julio R. Valdes, Ph.D., Professor of Civil, Construction, and Environmental Engineering [Senate Distinguished Professor]
Thais da Costa Alves, Ph.D., Associate Professor of Civil, Construction, and Environmental Engineering, Director of Construction Engineering Management
Robert K. Dowell, Ph.D., P.E., Associate Professor of Civil, Construction, and Environmental Engineering (Graduate Adviser)
Alicia M. Kinoshita, Ph.D., Associate Professor of Civil, Construction, and Environmental Engineering
Panagiotis Mitropoulos, Ph.D., P.E., Associate Professor of Civil, Construction, and Environmental Engineering, Director of Construction Engineering
Natalie Mladenov, Ph.D., Associate Professor of Civil, Construction, and Environmental Engineering, The William E. Leonhard, Jr. Chair in Civil, Construction, and Environmental Engineering
Reza Akhavian, Ph.D., Assistant Professor of Civil, Construction, and Environmental Engineering
Christine Dykstra, Ph.D., Assistant Professor of Civil, Construction, and Environmental Engineering
Sahar Ghanipoor Machiani, Ph.D., Assistant Professor of Civil, Construction, and Environmental Engineering
Arash Jahangiri, Ph.D., Assistant Professor of Civil, Construction, and Environmental Engineering
Marta Miletic, Ph.D., Assistant Professor of Civil, Construction, and Environmental Engineering
Hassan Tavakol-Davani, Ph.D., Assistant Professor of Civil, Construction, and Environmental Engineering
Matthew E. Verbyla, Ph.D., Assistant Professor of Civil, Construction, and Environmental Engineering

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 Blasker Chair in Environmental Engineering

The Blasker Chair in Environmental Engineering was established by an endowment from the Blasker-Rose-Miah Endowment Fund of the San Diego Foundation. The fund was created in honor of Mr. Samuel Blasker who left $8.0 million to the San Diego Foundation. Mr. Blasker was a successful aeronautical engineer and a business man with a vision to nurture and develop unique and innovative discoveries and experiences which may be of benefit to humanity.

The current appointee to the Chair, Dr. Temesgen Garoma Ararsso, is an accomplished scholar with teaching and research emphasis on renewable energy, resource recovery, and water and wastewater treatment.

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.

Courses Acceptable for Master's Degree Programs in Civil, Construction and Environmental Engineering (CIV E) (CON E) (ENV E)

Refer to Courses and Curricula and Regulations of the Division of Graduate Affairs sections of this bulletin for explanation of the course numbering system, unit or credit hour, prerequisites, and related information.

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

Civil Engineering (CIV E)
UPPER DIVISION COURSES

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.

Construction Engineering (CON E)
UPPER DIVISION COURSES

CON E 520. Environmentally Conscious Construction (3)

Two lectures and three hours of laboratory.

Prerequisite: Construction Engineering 312 for construction engineering and construction management majors; Civil Engineering 444 for civil engineering majors; concurrent registration in Civil Engineering 495 for environmental engineering majors.

Design and design processes to target a sustainable structure. Construction practices associated with protection of environment. Application of industry standards for environmental and energy performance of buildings. Impacts on selection of methods, materials, and equipment for construction. Design of procurement and management systems to support environmentally conscious building. Commissioning and startup. (Formerly numbered Construction Engineering 420.)

CON E 590. Construction Management and Safety (3)

Prerequisites: Construction Engineering 330 and 401.

Management and control of critical project processes for construction projects. Definition, planning, and execution of projects based on plan, estimate, and bid documentation. Fundamentals of construction safety planning, design, and requirements. (Formerly numbered Construction Engineering 490.)

Environmental Engineering (ENV E)
UPPER DIVISION COURSES

ENV E 554. Process Fundamentals of Environmental Systems (3)

Prerequisites: Environmental Engineering 355 with a grade of C (2.0) or better, Aerospace Engineering 340, Civil Engineering 444, and Mechanical Engineering 350.

Equilibrium and kinetics of chemical and biological reactions of environmental systems. Considerations of mass-transfer and fluid dynamics in water quality management and air pollution control.

ENV E 555. Sustainable Water and Sanitation Systems (3)

Two lectures and two hours of technical activity and laboratory.

Prerequisite: Environmental Engineering 355.

Design and selection of technologies for water delivery, reuse, sanitation, and treatment in developed and developing communities.

ENV E 556. Air Pollution Engineering (3)

Prerequisites: Senior standing and Environmental Engineering 355.

Sources of air pollutants. Transportation, dispersion, and transformation of pollutants in the atmosphere. Measurement and control of air pollution.

ENV E 558. Solid and Hazardous Waste Engineering (3)

Prerequisites: Senior standing and Environmental Engineering 355.

Municipal solid and hazardous solid wastes from an environmental engineering perspective, including waste minimization and recycling. Engineered volume reduction through composting, incineration, mechanical compaction, and other methods. Ultimate disposal, landfill design and legislative regulations.

ENV E 596. Advanced Environmental Engineering Topics (1-3)

Prerequisite: Consent of instructor.

Modern developments in environmental engineering. May be repeated with new content. See *Class Schedule* for specific content. Maximum credit of six units for any combination of Environmental 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.

Civil Engineering (CIV E)
GRADUATE COURSES

CIV E 605. Prestressed Concrete Structures (3)

Prerequisite: Civil Engineering 421 with minimum grade of C.

Fundamental concepts of prestressed concrete theory. Design applications to various types of structures.

CIV E 607. Dynamics of Structures (3)

Prerequisite: Civil Engineering 521 with minimum grade of C.

Dynamic disturbances, structures with variable degelastic beams; continuous beams, rigid frames, floor systems. Energy methods in structural dynamics.

CIV E 608. Earthquake Engineering (3)

Prerequisite: Civil Engineering 607.

Elements of seismology. Methods of analysis for earthquake loads. Procedures and code provisions for the design of earthquake-resistant structures.

CIV E 610. Finite Element Analysis of Structures (3)

Prerequisite: Civil Engineering 321 with minimum grade of C.

General procedure, various types of finite elements; analysis and design of isotropic and orthotropic plates and shells, deep beams, and shear walls using finite element technique; use of digital computers for solutions. Application to civil engineering structures.

CIV E 612. Advanced Concrete Materials (3)

Two lectures and three hours of laboratory.

Prerequisite: Civil Engineering 421.

Microstructure and cracking behavior of concrete. Theory and application of high strength and fiber reinforced concrete. Concrete durability additives and fiber reinforced plastic reinforcement for concrete. Innovative applications of advanced concrete materials. Includes a laboratory project.

CIV E 620. Traffic Flow and Control (3)
Prerequisite: Civil Engineering 481 or City Planning 625, with minimum grade of C.
Advanced treatment of traffic flow and control issues. Highway capacity and traffic flow characteristics, traffic flow modeling, intersection control, freeway control systems, intelligent transportation systems.

CIV E 621. Transportation Demand Analysis (3)
Prerequisite: Civil Engineering 481 or City Planning 625, with minimum grade of C.
Travel demand modeling with emphasis on application to growing metropolitan areas; four-step travel demand forecasting; disaggregate, behavioral, and activity-based approaches; recent methodological developments; transportation-land use interactions.

CIV E 622. Mass Transit Engineering (3)
Prerequisite: Civil Engineering 481 or City Planning 625, with minimum grade of C.
Transit system characteristics, analysis of demand for transit services, transit system planning, scheduling, analysis and design.

CIV E 631. Spatial Hydrology (3)
Prerequisite: Civil Engineering 445 with a minimum grade of C or graduate standing.
Integration of spatial data analysis and hydrologic modeling. Quantification of spatially distributed hydrologic characteristics. Decomposition of drainage network systems to support quasi-distributed hydrologic modeling. Quantification of hydrologic impacts due to model resolution, altered land use conditions, and modeling techniques.

CIV E 632. Computational Hydraulics and Hydrology (3)
Prerequisites: Civil Engineering 445 and 530.
Computational methods applied to hydraulics and hydrology. Explicit and implicit schemes for solving hyperbolic problems. Method of characteristics. One- and two-dimensional nonsteady open channel flow simulation.

CIV E 633. Environmental Hydrology (3)
Prerequisites: Civil Engineering 445 and Environmental Engineering 355.
Hydrosphere function, hydroclimatology, hydrographic characteristics, desertification, hydroecology, salinity modeling and management, stream and lake restoration, and case studies.

CIV E 634. Surface Water Hydrology (3)
Prerequisite: Civil Engineering 445.
Hydrologic systems. Physical hydrology. Kinematic wave theory. Diffusion and dynamic wave theories. Watershed and stream channel routing. Hydrologic simulation.

CIV E 638. Sedimentation Engineering (3)
Prerequisite: Civil Engineering 444 with minimum grade of C.
Hydraulics of sediment transport; erosion and sedimentation problems; river mechanics and morphology; mathematical modeling of river hydraulics; sediment transport and river channel changes. Design and environmental problems; erosion control and river training.

CIV E 640. Advanced Soil Mechanics (3)
Prerequisites: Civil Engineering 462 and 463 with minimum grades of C.
Advanced theories of soil mechanics applied to geotechnical and environmental engineering. Classification of terrestrial and marine soils, compaction, consolidation, expansion, stress distribution, strength, permeability and seepage, site improvement, and remediation.

CIV E 641. Advanced Foundation Engineering (3)
Prerequisites: Civil Engineering 462 and 463 with minimum grades of C.
Advanced theories of soil bearing capacity, settlement, and stress distribution applied to design of shallow and deep foundations and earth retaining structures. Subsurface exploration and dewatering methods.

CIV E 642. Groundwater Seepage and Earth Dams (3)
Prerequisites: Civil Engineering 462 and 463 with minimum grades of C.
Groundwater seepage and contaminant transport in saturated and unsaturated soils. Flow nets for homogeneous and layered soils. Design and stability analysis of embankments and earth dams.

CIV E 644. Soil Dynamics (3)
Prerequisites: Civil Engineering 462 and 463 with a minimum grade of C.
Behavior of soil and soil-structure systems under dynamic loading. Applications include dynamic earth bearing capacity and pressure, soil spring constants for machine foundation design, liquefaction analysis, site response spectra, and seismic stability of slopes. Case histories discussed.

CIV E 696. Advanced Topics in Civil Engineering (2-3)
Intensive study in specific areas of civil engineering. May be repeated with new content. See *Class Schedule* for specific content. Credit for 596 and 696 applicable to a master's degree with approval of the graduate adviser.

CIV E 697. Traffic Signal Systems Operations and Control (3)
Prerequisite: Graduate standing.
State-of-the-art traffic signal system control to include advanced traffic control strategies, incorporation of surface street systems into Intelligent Transportation Systems (ITS), signal system design and operations, and traffic simulation techniques.

CIV E 730. Advanced Topics in Water Engineering (3)
Prerequisites: Civil Engineering 530 and consent of instructor.
Advanced treatment of several fields in water engineering to include time series analysis, hydromodification, and online hydrologic modeling.

CIV E 781. Seminar in Transportation Engineering (2-3)
Prerequisites: Minimum grade point average of 3.0 and consent of instructor.
An intensive study in transportation engineering. Maximum credit six units applicable to a master's degree.

CIV E 797. Independent Research (1-3) Cr/NC/RP
Prerequisite: Consent of graduate adviser.
Independent research in civil and environmental engineering. Maximum credit three units applicable to a master's degree.

CIV E 798. Special Study (1-3) Cr/NC/RP
Prerequisite: Consent of staff; to be arranged with department chair and instructor.
Individual study. Maximum credit three units applicable to a master's degree.

CIV E 799A. Thesis or Project (3) Cr/NC/RP
Prerequisites: An officially appointed thesis committee and advancement to candidacy.
Preparation of a project or thesis for the master's degree.

CIV E 799B. Thesis or Project Extension (0) Cr/NC
Prerequisite: Prior registration in Thesis or Project 799A with an assigned grade symbol of RP.
Registration required in any semester or term following assignment of RP in Course 799A in which the student expects to use the facilities and resources of the university; also student must be registered in the course when the completed thesis or project is granted final approval.

CIV E 799C. Comprehensive Examination Extension (0) Cr/NC
Prerequisite: Completion or concurrent enrollment in degree program courses.
Registration required of students whose only requirement is completion of the comprehensive examination for the master's degree. Registration in 799C limited to two semesters.

Construction Engineering (CON E)
GRADUATE COURSES

CON E 650. Construction Labor Productivity (3)
Prerequisites: Construction Engineering 301 and 401.
Definition of productivity measures and factors that affect productivity of construction labor. Quantification techniques of labor productivity in construction.

CON E 651. Project Production System Design in Construction (3)
Prerequisites: Construction Engineering 650 or Construction Engineering 310, 401, and 490.
Theory of project production system design. Relation to production management theories, productivity improvement techniques, data gathering techniques to support process evaluation. Civil design and construction operations but also applicable to other industries.

CON E 652. Construction Operations Modeling and Technology (3)
Prerequisites: Construction Engineering 310, 401, 651, and Civil Engineering 220.
Modeling and optimizing construction projects and constructed works. Abstraction of projects, process mapping, and activity quantification. Theories of queuing and batching. Numerico-physical modeling of construction operations in time and space. Systems integration.

CON E 653. Construction Scheduling (3)
Prerequisites: Construction Engineering 301 and 401.
Construction planning, scheduling and evaluation of planning techniques, labor, and equipment leveling, expecting cost and crashing, resource loading, what if scenarios, and use of scheduling in delay analysis.

CON E 654. Construction Claims (3)
Prerequisite: Construction Engineering 301.
Basic foundations construction claims process starting with an understanding of contractual basis for construction claims through final resolution of claims. Clauses that form the basis for claims; recognition of claims, communicating claims elements, pricing claims, and methods for resolving claims.

CON E 655. Project Design and Portfolio Management (3)
Prerequisites: Construction Engineering 651 or Civil Engineering 495; and Environmental Engineering 320 or 355.
Techniques for project selection, definition, design management and value generation, including consideration of ROI, feasibility, and portfolio diversification. Incorporation of life-cycle considerations into all levels of design, including concepts of sustainability. Owner, designer, and contractor perspectives.

Environmental Engineering (ENV E)
GRADUATE COURSES

ENV E 637. Process Design for Industrial and Hazardous Waste Treatment (3)
Prerequisites: Environmental Engineering 647 and 648.
Process design of physical, chemical, and biological methods for treatment of hazardous and industrial waste.

ENV E 645. Aquatic Chemistry for Environmental Engineers (3)
Prerequisite: Classified graduate standing.
Chemistry of natural and polluted water. Process chemistry for water and wastewater treatment.

ENV E 646. Microbiological Principles of Environmental Engineering (3)
Prerequisite: Graduate standing.
Relationships and significance of microorganisms to organic matter decomposition, mineral transformations, and environmental quality. Applied study in natural (water, sediments, wetlands) and disturbed ecosystems (landfills, contaminated sediments, and groundwater).

ENV E 647. Physical and Chemical Processes of Water Pollution Control (3)
Prerequisites: Environmental Engineering 554 and 645.
Engineering principles and design of physical and chemical processes used in water and wastewater treatment.

ENV E 648. Biological Processes and Bioremediation Engineering (3)
Prerequisite: Environmental Engineering 554.
Engineering principles and design of biological processes used in wastewater and bioremediation treatment technologies.

ENV E 696. Advanced Topics in Environmental Engineering (2-3)
Intensive study in specific areas of environmental engineering. May be repeated with new content. See *Class Schedule* for specific content. Credit for 596 and 696 applicable to a master's degree with approval of the graduate adviser.

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Prerequisite: Consent of graduate adviser.
Independent research in civil and environmental engineering. Maximum credit three units applicable to a master's degree.

ENV E 798. Special Study (1-3) Cr/NC/RP
Prerequisite: Consent of staff; to be arranged with department chair and instructor.
Individual study. Maximum credit three units applicable to a master's degree.

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