

CIVIL & ENVIRONMENTAL ENGINEERING (ECI)

College of Engineering

ECI 003 – Civil & Environmental Infrastructure & Society (4 units)

This version has ended; see updated course, below.

Course Description: Introduction to civil infrastructure and its relationship with society and the natural environment. Exposure to innovative research on civil engineering and environmental systems. Participation in laboratory experiments illustrative of the solution of representative but simplified engineering problems.

Prerequisite(s): MAT 021A (can be concurrent).

Learning Activities: Lecture 3 hour(s), Laboratory 2 hour(s).

Enrollment Restriction(s): Pass One restricted to Civil Engineering and Environmental Engineering majors; not open for credit to upper division students.

Grade Mode: Letter.

General Education: Science & Engineering (SE) or Social Sciences (SS).

ECI 003 – Civil & Environmental Infrastructure & Society (4 units)

Course Description: Introduction to civil infrastructure and its relationship with society and the natural environment. Exposure to innovative research on civil engineering and environmental systems. Participation in laboratory experiments illustrative of the solution of representative but simplified engineering problems.

Prerequisite(s): MAT 021A (can be concurrent).

Learning Activities: Lecture 3 hour(s), Laboratory 2 hour(s).

Enrollment Restriction(s): Pass One open to lower division Civil Engineering and Environmental Engineering majors; Pass Two open to lower division students; attendance is mandatory on the first day of class and lab.

Grade Mode: Letter.

General Education: Science & Engineering (SE) or Social Sciences (SS).

This course version is effective from, and including: Fall Quarter 2025.

ECI 016 – Spatial Data Analysis (2 units)

Course Description: Computer-aided design and geographic information systems in civil engineering practice.

Learning Activities: Lecture 1 hour(s), Laboratory 3 hour(s).

Enrollment Restriction(s): Restricted to Civil Engineering, Environmental Engineering and Biological Systems Engineering majors; non-majors accommodated on a space-available basis.

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL).

ECI 040 – Introduction to Environmental Engineering (4 units)

This version has ended; see updated course, below.

Course Description: Introduction to topics in environmental engineering; discussion on influence of literary work, art, and media on the evolution of environmental engineering practice, relevant laws, and regulations; presentations of historical case studies. Major themes include sustainability, environmental justice, and laws/regulations.

Prerequisite(s): CHE 002B.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Enrollment Restriction(s): Pass One restricted to Environmental Engineering and Civil Engineering majors only.

Grade Mode: Letter.

General Education: Science & Engineering (SE) or Social Sciences (SS).

ECI 040 – Introduction to Environmental Engineering (4 units)

Course Description: Introduction to topics in environmental engineering; discussion on influence of literary work, art, and media on the evolution of environmental engineering practice, relevant laws, and regulations; presentations of historical case studies. Major themes include sustainability, environmental justice, and laws/regulations.

Prerequisite(s): CHE 002B.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Enrollment Restriction(s): Pass One open to Environmental Engineering majors only.

Grade Mode: Letter.

General Education: Science & Engineering (SE) or Social Sciences (SS).

This course version is effective from, and including: Fall Quarter 2025.

ECI 090X – Lower Division Seminar (1-4 units)

Course Description: Examination of a special topic in a small group setting.

Prerequisite(s): Consent of instructor.

Learning Activities: Seminar 1-4 hour(s).

Repeat Credit: May be repeated.

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 092 – Internship for Engineering (1-5 units)

Course Description: Supervised work experience in civil engineering.

Prerequisite(s): Lower division standing; approval of project prior to period of internship.

Learning Activities: Internship.

Repeat Credit: May be repeated.

Grade Mode: Pass/No Pass only.

General Education: Science & Engineering (SE).

ECI 098 – Directed Group Study (1-5 units)

Course Description: Directed group study.

Prerequisite(s): Consent of instructor. Lower division standing.

Learning Activities: Variable.

Grade Mode: Pass/No Pass only.

General Education: Science & Engineering (SE).

ECI 099 – Special Study for Undergraduates (1-5 units)

Course Description: Special study for undergraduates.

Prerequisite(s): Consent of instructor. Lower division standing.

Learning Activities: Variable.

Grade Mode: Pass/No Pass only.

General Education: Science & Engineering (SE).

ECI 100 – Introduction to Fluid Mechanics for Civil & Environmental Engineers (4 units)

Course Description: Fluid flow in civil & environmental engineering, basis for design, buoyancy, hydrostatics, gravity dams, hydraulic modeling; similarity & scaling, conservation laws, flow in bends, nozzles, pipes, pumps, turbines, complimentary lab experiments.

Prerequisite(s): ENG 035 C- or better; (MAT 022B C- or better or MAT 027B C- or better); PHY 009B C- or better.

Learning Activities: Lecture 3 hour(s), Laboratory 3 hour(s).

Enrollment Restriction(s): Pass One restricted to Civil Engineering, Environmental Engineering and Hydrology majors.

Credit Limitation(s): Not open for credit to students who have taken ENG 103.

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 101 – Transfer Transition for Civil & Environmental Engineering (4 units)

Course Description: Introduction to the Department of Civil and Environmental Engineering for transfer and junior-level change-of-major students. Exploration of civil and environmental engineering disciplines and active areas of research in the department. Interaction with faculty in the department and campus student services that can support them while at UC Davis.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Enrollment Restriction(s): Open to first-quarter transfer students and third-year change-in-major students in Civil Engineering and Environmental Engineering majors only.

Repeat Credit: Not open for credit to students who have taken ECI 003.

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 114 – Probabilistic Systems Analysis for Civil & Environmental Engineers (4 units)

Course Description: Probabilistic concepts and models in engineering. Statistical analysis of engineering experimental and field data. Introduction to stochastic processes and models of engineering systems.

Prerequisite(s): MAT 021C C- or better.

Learning Activities: Lecture 4 hour(s).

Enrollment Restriction(s): Pass one open to Civil Engineering & Environmental Engineering majors only.

Credit Limitation(s): Not open for credit to students who have completed STA 120.

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL).

ECI 115 – Computer Methods in Civil & Environmental Engineering (4 units)

Course Description: Presentation, implementation and application of numerical algorithms and computer models for the solution of practical problems in Civil and Environmental Engineering.

Prerequisite(s): (ENG 006 C- or better or ECS 030 C- or better or ECS 032A C- or better or ECS 032AV C- or better); (MAT 022B C- or better or MAT 027B C- or better).

Learning Activities: Lecture 3 hour(s), Laboratory 1 hour(s).

Enrollment Restriction(s): Pass One Restricted to Civil Engineering and Environmental Engineering majors.

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 123 – Urban Systems & Sustainability (4 units)

Course Description: Systems-level approach of how to evaluate and then modify sustainability of urban systems based on interaction with natural environments. Topics include: definition/metrics of urban sustainability; system analyses of urban systems; enabling technology, policies, legislation; measures and modification of ecological footprints. May be taught abroad.

Prerequisite(s): Upper division standing.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE) or Social Sciences (SS); American Cultures, Governance, & History (ACGH); Domestic Diversity (DD); Scientific Literacy (SL).

ECI 130 – Structural Analysis (4 units)

Course Description: Elastic structural analysis of determinate and indeterminate trusses, beams and frames. Plastic bending and limit analysis.

Prerequisite(s): (ENG 104 C- or better or ENG 104V C- or better); (MAT 022A or MAT 027A).

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Enrollment Restriction(s): Open to Civil Engineering majors.

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL).

ECI 131 – Matrix Structural Analysis (4 units)

Course Description: Matrix formulation and computer analysis of statically indeterminate structures. Stiffness and flexibility formulations for elastic structures. Finite element methods for elasticity and bending problems.

Prerequisite(s): (ENG 104 C- or better or ENG 104V C- or better); ENG 006.

Learning Activities: Lecture 3 hour(s), Laboratory 3 hour(s).

Enrollment Restriction(s): Open to Engineering majors only.

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 132 – Structural Design: Metallic Elements (4 units)

Course Description: Design of metallic beams, columns, and other members for various types of loading and boundary conditions; design of connections between members; member performance within structural systems.

Prerequisite(s): ENG 104 C- or better or ENG 104V C- or better.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 133 – Structure & Properties of Civil Engineering Materials (4 units)

Course Description: Structures & properties of common civil engineering materials including concrete, alloys, plastics, and wood. Mechanical behavior of elastic & plastic response to loading, thermal conductivity and resistivity, diffusivity, and deterioration mechanisms.

Prerequisite(s): CHE 002A C- or better; ENG 035 C- or better.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Enrollment Restriction(s): Pass One restricted to College of Engineering students.

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 134 – Structural Loads: Calculation & Modeling (4 units)

This version has ended; see updated course, below.

Course Description: Structural analysis process and model idealization; design codes, standards, and guidelines (e.g., IBC & ASCE 7); load paths for vertical and horizontal loads; load cases and load combinations; modeling of loads using finite element software; dead and live loads; snow loads; wind loads; climate change effects on snow and wind loads.

Prerequisite(s): ENG 104 C- or better or ENG 104V C- or better.

Learning Activities: Lecture 3 hour(s), Laboratory 3 hour(s).

Enrollment Restriction(s): Open to Civil Engineering majors only.

Grade Mode: Letter.

ECI 134 – Structural Loads: Calculation & Modeling (4 units)

Course Description: Structural analysis process and model idealization; design codes, standards, and guidelines (e.g., IBC & ASCE 7); load paths for vertical and horizontal loads; load cases and load combinations; modeling of loads using finite element software; dead and live loads; snow loads; wind loads; climate change effects on snow and wind loads.

Prerequisite(s): ENG 104 C- or better or ENG 104V C- or better.

Learning Activities: Lecture 3 hour(s), Laboratory 3 hour(s).

Enrollment Restriction(s): Pass One open to Civil Engineering majors.

Grade Mode: Letter.

This course version is effective from, and including: Fall Quarter 2025.

ECI 135 – Structural Design: Concrete Elements (4 units)

Course Description: Strength design procedures for columns, rectangular beams, T-beams and beams of general cross-section. Building code requirements for bending, shear, axial load, combined stresses and bond. Introduction to prestressed concrete.

Prerequisite(s): ENG 104 C- or better or ENG 104V C- or better.

Learning Activities: Lecture 3 hour(s), Laboratory 3 hour(s).

Enrollment Restriction(s): Restricted to Civil Engineering, Civil Engineering/Materials Science and Engineering, and Materials Science and Engineering majors only.

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 136 – Building Design (4 units)

Course Description: Design of a building structure for a specific need under the multiple constraints of safety, serviceability, cost and aesthetics.

Prerequisite(s): (ECI 130 C- or better or ECI 131 C- or better); (ECI 135 or ECI 132).

Learning Activities: Lecture 3 hour(s), Laboratory 3 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 137 – Construction Principles & Project Management (4 units)

Course Description: Project management, with civil engineering construction and design applications, including project scope, schedule, resources, cost, quality, risk, and control. Construction industry overview. Interactions between planning, design, construction, operations. Construction operations analysis. Contract issues. Project management software, field trips, guest lectures.

Learning Activities: Lecture 3 hour(s), Laboratory 3 hour(s).

Enrollment Restriction(s): Restricted to upper division standing in Engineering.

Grade Mode: Letter.

General Education: Science & Engineering (SE) or Social Sciences (SS); Quantitative Literacy (QL).

ECI 138 – Earthquake Loads on Structures (4 units)

Course Description: Determination of loads on structures due to earthquakes. Methods of estimating equivalent static lateral forces; response spectrum and time history analysis. Concepts of mass, damping and stiffness for typical structures. Design for inelastic behavior. Numerical solutions and Code requirements.

Prerequisite(s): ENG 104 C- or better or ENG 104V C- or better.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 139 – Advanced Structural Mechanics (4 units)

Course Description: Review of stress, strain, equilibrium, compatibility, and elastic material behavior. Plane stress and plane strain problems in elasticity; energy methods. Theories for unsymmetric bending, straight and curved beams. Beams on elastic foundations; stresses in plates and shells; elastic stability.

Prerequisite(s): ENG 104 C- or better or ENG 104V C- or better.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL).

ECI 140A – Environmental Analysis of Aqueous Systems (4 units)

Course Description: Introduction to "wet chemical" and instrumental techniques commonly used in the examination of water and wastewater and associated data analysis.

Prerequisite(s): CHE 002B C- or better; ECI 040.

Learning Activities: Lecture 3 hour(s), Laboratory 3 hour(s).

Enrollment Restriction(s): Pass One restricted to Environmental Engineering majors.

Credit Limitation(s): Not open for credit to students who have taken ECH 140 or CHE 100.

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 140B – Chemical Principles for Environmental Engineers (4 units)

Course Description: Aqueous chemistry; equilibrium relationships; carbonate system; thermodynamics; kinetics & rate laws; precipitation, adsorption, & volatilization phenomenon; oxidation & reduction reactions; pH, pE and predominance diagrams; organic chemicals.

Prerequisite(s): ECI 140A C- or better.

Learning Activities: Lecture 4 hour(s).

Credit Limitation(s): Not open for credit to students who have taken ECI 140.

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 140CN – Water & Wastewater Treatment System Design (4 units)

Course Description: Evaluation and design of water and wastewater treatment systems. May be taught abroad.

Prerequisite(s): ECI 140A C- or better; ECI 140B C- or better.

Learning Activities: Lecture 3 hour(s), Laboratory 3 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 141 – Engineering Hydraulics (3 units)

Course Description: Nature of flow of a real fluid; flow in pipes; open channel flow; turbomachinery; fluid forces on objects: boundary layers, lift and drag.

Prerequisite(s): ENG 103 C- or better or ECI 100 C- or better.

Learning Activities: Lecture 3 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 141L – Engineering Hydraulics Laboratory (1 unit)

Course Description: Laboratory experiments and demonstrations on flow measurements, sluice gates, hydraulic jump, flow characteristics, and centrifugal pumps.

Prerequisite(s): ECI 141 (can be concurrent).

Learning Activities: Laboratory 3 hour(s).

Enrollment Restriction(s): Open to Engineering students only.

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 142 – Engineering Hydrology (4 units)

This version has ended; see updated course, below.

Course Description: The hydrologic cycle. Evapotranspiration, interception, depression storage and infiltration. Streamflow analysis and modeling. Flood routing through channels and reservoirs. Frequency analysis of hydrologic variables. Precipitation analysis for hydrologic design. Hydrologic design.

Prerequisite(s): ECI 141 (can be concurrent).

Learning Activities: Lecture 4 hour(s).

Enrollment Restriction(s): Restricted to students in the College of Engineering.

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL).

ECI 142 – Engineering Hydrology (4 units)

Course Description: The hydrologic cycle. Evapotranspiration, interception, depression storage and infiltration. Streamflow analysis and modeling. Flood routing through channels and reservoirs. Frequency analysis of hydrologic variables. Precipitation analysis for hydrologic design. Hydrologic design.

Prerequisite(s): ECI 141 (can be concurrent).

Learning Activities: Lecture 4 hour(s).

Enrollment Restriction(s): Pass One open to Civil Engineering and Environmental Engineering majors.

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL).

This course version is effective from, and including: Fall Quarter 2025.

ECI 144 – Groundwater Systems Design (4 units)

Course Description: Groundwater occurrence, distribution, and movement; groundwater flow systems; radial flow to wells and aquifer testing; aquifer management; groundwater contamination; solute transport by groundwater; fate and transport of subsurface contaminants. Groundwater supply and transport modeling.

Prerequisite(s): ECI 141 C- or better.

Learning Activities: Lecture 3 hour(s), Laboratory 3 hour(s).

Enrollment Restriction(s): Pass One restricted to Environmental Engineering majors.

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 145 – Hydraulic Structure Design (4 units)

Course Description: Project-based course on the design of an integrated urban drainage system with focus on consideration of design alternatives, multiple realistic constraints, quantification of uncertainty, codes and standards, technical drawing and cost analysis.

Prerequisite(s): ECI 141 C- or better.

Learning Activities: Lecture 2 hour(s), Discussion 1 hour(s), Laboratory 3 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 146 – Water Resources Simulation (4 units)

Course Description: Computer simulation techniques in the analysis, design and operation of surface water systems; modeling concepts and practices with application to surface runoff; water quality in rivers and streams and dispersion of contaminants in water bodies.

Prerequisite(s): ECI 141 C- or better.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 149L – Air Pollution Lab (1 unit)

Course Description: Laboratory characterization of air pollutants; data analysis; experimental design.

Prerequisite(s): ECI 149 C- or better (can be concurrent).

Learning Activities: Laboratory 3 hour(s).

Grade Mode: Letter.

ECI 149N – Air Pollution (4 units)

Course Description: Physical and technical aspects of air pollution.

Factors that determine local, regional, and global air quality; climate change; and physical and chemical properties of pollutants.

Prerequisite(s): MAT 021D; (MAT 022B or MAT 027B); CHE 002B C- or better; (ATM 121A or ENG 103 C- or better or ECI 100 C- or better).

Learning Activities: Discussion 1 hour(s), Lecture 3 hour(s).

Cross Listing: ATM 149N.

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL); Scientific Literacy (SL).

ECI 153 – Deterministic Optimization & Design (4 units)

Course Description: Operations research. Optimization techniques such as linear programming, dynamic programming, and non-linear programming.

Applications in civil engineering disciplines, including multiple realistic constraints, through computer-based course projects.

Prerequisite(s): MAT 021C; (MAT 022A or MAT 027A); computer programming course.

Learning Activities: Lecture 3 hour(s), Laboratory 3 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL); Scientific Literacy (SL).

ECI 155 – Water Resources Engineering Planning (4 units)

Course Description: Basic engineering planning concepts; role of engineering, economic, environmental and social information and analysis; institutional, political and legal aspects. Case studies and computer models illustrate the planning of water resource systems.

Prerequisite(s): (ENG 106 or ECN 001A or ECN 001AY or ECN 001AV); ECI 114.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE) or Social Sciences (SS); Quantitative Literacy (QL); Scientific Literacy (SL); Writing Experience (WE).

ECI 161 – Transportation System Operations (4 units)

Course Description: Principles of transportation system operations; traffic characteristics and methods of measurement; models of transportation operations and congestion applied to urban streets and freeways.

Prerequisite(s): MAT 021C C- or better; PHY 009A C- or better.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL).

ECI 162 – Transportation Infrastructure Design (4 units)

Course Description: Foundation in roadway design with a multimodal perspective. Transportation content related to sight distance, horizontal and vertical roadway design. Holistic perspective to design for multiple roadway users including bicycles, pedestrians, vehicle sharing, and public transit.

Prerequisite(s): PHY 009A C- or better; MAT 021B C- or better.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Enrollment Restriction(s): Open to upper division students only; Pass One restricted to Civil Engineering majors.

Grade Mode: Letter.

ECI 163 – Energy & Environmental Aspects of Transportation (4 units)

Course Description: Engineering, economic, and systems planning concepts. Analysis and evaluation of energy, air quality and selected environmental attributes of transportation technologies. Strategies for reducing pollution and petroleum consumption in light of institutional and political constraints. Evaluation of vehicle emission models.

Prerequisite(s): Upper division standing in engineering or economics or environmental studies.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Enrollment Restriction(s): Pass One restricted to Civil Engineering, Environmental Science & Management, Environmental Policy Analysis & Planning majors.

Cross Listing: ESP 163.

Grade Mode: Letter.

General Education: Science & Engineering (SE) or Social Sciences (SS).

ECI 164 – Introduction to Electric Vehicles (4 units)

Course Description: Interdisciplinary exploration of electric vehicles. Underlying technology, challenges, and societal impacts. Battery technology, vehicle efficiency, charging infrastructure, total cost of ownership, consumer and travel behavior, life-cycle emissions, and policy landscape. Perspectives from engineering, physics, chemistry, economics, finance, public policy, and social sciences.

Learning Activities: Discussion 1 hour(s), Lecture 3 hour(s).

Grade Mode: Letter.

General Education: Scientific Literacy (SL); Science & Engineering (SE).

ECI 165 – Transportation Policy (4 units)

Course Description: Transportation and associated environmental problems confronting urban areas, and prospective technological and institutional solutions. Draws upon concepts and methods from economics, engineering, political science and environmental studies.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE) or Social Sciences (SS).

ECI 171 – Soil Mechanics (4 units)

Course Description: Soil formations, mass-volume relationships, soil classification, effective stress, soil-water-void relationships, compaction, seepage, capillarity, compressibility, consolidation, strength, states of stress and failure, lateral earth pressures, and slope stability.

Prerequisite(s): (ENG 103 (can be concurrent) or ECI 100 (can be concurrent)); (ENG 104 C- or better or ENG 104V C- or better); ECI 171L (can be concurrent); ECI 171L required concurrently.

Learning Activities: Lecture 4 hour(s).

Enrollment Restriction(s): Restricted to Civil Engineering and Environmental Engineering majors only.

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 171L – Soil Mechanics Laboratory (1 unit)

Course Description: Laboratory studies utilizing standard testing methods to determine physical, mechanical and hydraulic properties of soil and demonstration of basic principles of soil behavior.

Prerequisite(s): ECI 171 (can be concurrent); ECI 171 required concurrently.

Learning Activities: Laboratory 3 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 173 – Foundation Design (4 units)

Course Description: Foundation analysis and design, including site characterization, evaluation of shallow and deep foundation alternatives, evaluation of bearing capacity and settlements, design of retaining structures, and case-based design experiences.

Prerequisite(s): ECI 171.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 175 – Geotechnical Earthquake Engineering (4 units)

Course Description: Tectonics, faults, site response, and probabilistic ground motion prediction equations. Cyclic loading and liquefaction of soil elements and layers. Empirical procedures and field tests for evaluation of triggering and consequences, of liquefaction.

Prerequisite(s): ECI 171 C- or better.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 178 – Pavement Engineering & Design (4 units)

Course Description: Pavement types (rigid, flexible, unsurfaced, rail), their applications (roads, airfields, ports, rail) and distress mechanisms. Materials, traffic and environment characterization. Empirical and mechanistic-empirical design procedures. Construction quality; asphalt concrete mix design.

Prerequisite(s): (ENG 104 C- or better or ENG 104V C- or better); ECI 171 C- or better recommended.

Learning Activities: Lecture 3 hour(s); Laboratory 3 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL); Scientific Literacy (SL); Visual Literacy (VL).

ECI 179 – Pavement Management, Evaluation, & Rehabilitation (4 units)

Course Description: Engineering concepts and practices to evaluate, preserve, maintain and rehabilitate highway pavements, focusing on pavement asset management, pavement failure mechanisms, site investigation for rehabilitation design, flexible and rigid pavement preservation and maintenance, flexible & rigid overlays, economic analysis of rehabilitation alternatives and selection of the most suitable strategy.

Prerequisite(s): ENG 104 C- or better or ENG 104 C- or better; ECI 178 C- or better recommended.

Learning Activities: Lecture 3 hour(s), Laboratory 3 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 181 – Construction Cost Estimation & Analysis (4 units)

Course Description: Fundamentals of cost estimation within the construction industry. Methodologies and use of estimating processes through each stage of project acquisition and delivery. Case-study based projects involve current technologies and estimating practices.

Learning Activities: Lecture 3 hour(s); Laboratory 3 hour(s).

Grade Mode: Letter.

ECI 182 – Buildings: Assemblage & Construction Quality Management (4 units)

Course Description: Materials and methods used in building construction.

Assemblage of construction materials in building systems and related effects on productivity, equipment selection and job site layout.

Learning Activities: Lecture 3 hour(s); Laboratory 3 hour(s).

Grade Mode: Letter.

ECI 183 – Heavy Civil Construction (4 units)

Course Description: Means and methods used to build civil infrastructure. Construction of bridges, tunnels, roads, railroads, dams, water and wastewater treatment facilities, utilities, foundations, and port facilities. Industry experts, collaborative group discussions, building exercises, construction site visits, and hands-on building projects.

Prerequisite(s): ECI 137 recommended.

Learning Activities: Lecture 3 hour(s), Laboratory 2 hour(s).

Enrollment Restriction(s): Open to Civil Engineering, Electrical Engineering, and Mechanical Engineering students only.

Grade Mode: Letter.

ECI 189A – Selected Topics in Civil Engineering: Environmental Engineering (1-5 units)

Course Description: Directed group study in Environmental Engineering.

Prerequisite(s): Consent of instructor.

Learning Activities: Variable.

Repeat Credit: May be repeated when topic differs.

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 189B – Selected Topics in Civil Engineering: Hydraulics & Hydrologic Engineering (1-5 units)

Course Description: Directed group study in Hydraulics & Hydrologic Engineering.

Prerequisite(s): Consent of instructor.

Learning Activities: Variable.

Repeat Credit: May be repeated when topic differs.

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 189C – Selected Topics in Civil Engineering: Engineering Planning (1-5 units)

Course Description: Directed group study in Engineering Planning.

Prerequisite(s): Consent of instructor.

Learning Activities: Variable.

Repeat Credit: May be repeated when topic differs.

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 189D – Selected Topics in Civil Engineering: Geotechnical Engineering (1-5 units)

Course Description: Directed group study in Geotechnical Engineering.

Prerequisite(s): Consent of instructor.

Learning Activities: Variable.

Repeat Credit: May be repeated when topic differs.

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 189E – Selected Topics in Civil Engineering: Structural Engineering (1-5 units)

Course Description: Directed group study in Structural Engineering.

Prerequisite(s): Consent of instructor.

Learning Activities: Variable.

Repeat Credit: May be repeated when topic differs.

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 189F – Selected Topics in Civil Engineering: Structural Mechanics (1-5 units)

Course Description: Directed group study in Structural Mechanics.

Prerequisite(s): Consent of instructor.

Learning Activities: Variable.

Repeat Credit: May be repeated when topic differs.

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 189G – Selected Topics in Civil Engineering: Transportation Engineering (1-5 units)

Course Description: Directed group study in Transportation Engineering.

Prerequisite(s): Consent of instructor.

Learning Activities: Variable.

Repeat Credit: May be repeated when topic differs.

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 189H – Selected Topics in Civil Engineering: Transportation Planning (1-5 units)

Course Description: Directed group study in Transportation Planning.

Prerequisite(s): Consent of instructor.

Learning Activities: Variable.

Repeat Credit: May be repeated when topic differs.

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 189I – Selected Topics in Civil Engineering: Water Resources Engineering (1-5 units)

Course Description: Directed group study in Water Resources Engineering.

Prerequisite(s): Consent of instructor.

Learning Activities: Variable.

Repeat Credit: May be repeated when topic differs.

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 189J – Selected Topics in Civil Engineering: Water Resources Planning (1-5 units)

Course Description: Directed group study in Water Resources Planning.

Prerequisite(s): Consent of instructor.

Learning Activities: Variable.

Repeat Credit: May be repeated when topic differs.

Grade Mode: Letter.

General Education: Science & Engineering (SE).

ECI 190C – Research Group Conferences in Civil & Environmental Engineering (1 unit)

Course Description: Research group conferences.

Prerequisite(s): Consent of instructor. Upper division standing in Civil and Environmental Engineering.

Learning Activities: Discussion 1 hour(s).

Repeat Credit: May be repeated.

Grade Mode: Pass/No Pass only.

General Education: Science & Engineering (SE).

ECI 191C – Civil & Environmental Engineering Career Pathways (1 unit)

Course Description: Demonstration of different civil and environmental engineering career options; engagement with CEE alumni through panels.

Learning Activities: Lecture/Discussion 1 hour(s).

Grade Mode: P/NP only.

ECI 192 – Internship in Engineering (1-5 units)

Course Description: Supervised work experience in civil engineering.

Prerequisite(s): Upper division standing; approval of project prior to the period of the internship.

Learning Activities: Internship.

Repeat Credit: May be repeated.

Grade Mode: Pass/No Pass only.

General Education: Science & Engineering (SE).

ECI 193A – Civil & Environmental Engineering Senior Design (4 units)

This version has ended; see updated course, below.

Course Description: Culminating design experience for civil engineering and environmental engineering majors. Student teams work closely with faculty, city officials or consulting clients to propose, implement and validate a unique solution to a real-world problem.

Prerequisite(s): ECI 114 C- or better; (ECI 115 C- or better or ECI 153 C- or better or MAT 118A C- or better); (ECI 140CN C- or better or (ECI 171 C- or better, ECI 171L C- or better) or (ECI 132 C- or better, ECI 134 C- or better) or (ECI 132 C- or better, ECI 135 C- or better) or (ECI 134 C- or better, ECI 135 C- or better) or (ECI 161 C- or better, ECI 162 C- or better) or (ECI 162 C- or better, ECI 163 C- or better) or (ECI 163 C- or better, ECI 161 C- or better) or (ECI 141 C- or better, ECI 141L C- or better)), (UWP 101 or UWP 102E or UWP 102G or UWP 104A or UWP 104E or UWP 104T).

Learning Activities: Lecture 2 hour(s), Laboratory 3 hour(s).

Enrollment Restriction(s): Restricted to seniors in Civil Engineering and Environmental Engineering.

Grade Mode: Letter.

General Education: Science & Engineering (SE); Oral Skills (OL).

ECI 193A – Civil & Environmental Engineering Senior Design (4 units)

Course Description: Culminating design experience for civil engineering and environmental engineering majors. Student teams work closely with faculty, city officials or consulting clients to propose, implement and validate a unique solution to a real-world problem.

Prerequisite(s): ECI 114 C- or better; (ECI 115 C- or better or ECI 153 C- or better or MAT 118A C- or better); (ECI 140CN C- or better or (ECI 171 C- or better, ECI 171L C- or better) or (ECI 130 C- or better, ECI 132 C- or better, ECI 134 C- or better) or (ECI 130 C- or better, ECI 132 C- or better, ECI 135 C- or better) or (ECI 130 C- or better, ECI 134 C- or better, ECI 135 C- or better) or (ECI 161 C- or better, ECI 162 C- or better) or (ECI 162 C- or better, ECI 163 C- or better) or (ECI 163 C- or better, ECI 161 C- or better) or (ECI 141 C- or better, ECI 141L C- or better)), (UWP 101 or UWP 102E or UWP 102G or UWP 104A or UWP 104E or UWP 104T).

Learning Activities: Lecture 2 hour(s), Laboratory 3 hour(s).

Enrollment Restriction(s): Restricted to seniors in Civil Engineering and Environmental Engineering.

Grade Mode: Letter.

General Education: Science & Engineering (SE); Oral Skills (OL).

This course version is effective from, and including: Winter Quarter 2026.

ECI 193B – Civil & Environmental Engineering Senior Design (4 units)

Course Description: Culminating design experience for civil engineering and environmental engineering majors. Student teams work closely with faculty, city officials or consulting clients to propose, implement and validate a unique solution to a real-world problem.

Prerequisite(s): ECI 193A.

Learning Activities: Lecture 1 hour(s), Laboratory 3 hour(s).

Enrollment Restriction(s): Open to seniors in Civil Engineering and Environmental Engineering only.

Grade Mode: Letter.

General Education: Science & Engineering (SE); Oral Skills (OL); Visual Literacy (VL).

ECI 198 – Directed Group Study (1-5 units)

Course Description: Directed group study. May be taught abroad.

Prerequisite(s): Consent of instructor.

Learning Activities: Variable.

Grade Mode: Pass/No Pass only.

General Education: Science & Engineering (SE).

ECI 199 – Special Study for Advanced Undergraduates (1-5 units)

Course Description: Special study. May be taught abroad.

Prerequisite(s): Consent of instructor.

Learning Activities: Variable 3-15 hour(s).

Grade Mode: Pass/No Pass only.

General Education: Science & Engineering (SE).

ECI 201 – Introduction to Theory of Elasticity (4 units)

Course Description: Fundamental equations of elasticity in three dimensions; plane stress and plane strain; flexure and torsion of bars of various shapes. Introduction to variational and approximate methods.

Prerequisite(s): ENG 104 or ENG 104V.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Grade Mode: Letter.

ECI 203 – Inelastic Behavior of Solids (4 units)

Course Description: Fundamentals of theories of plasticity, viscoelasticity and viscoplasticity for solids. Macroscopic constitutive modelling for engineering materials, e.g., metals, polymers, soils, etc., and microscopic motivation.

Prerequisite(s): ECI 201.

Learning Activities: Lecture 4 hour(s).

Enrollment Restriction(s): Open to graduate students only.

Grade Mode: Letter.

ECI 205 – Continuum Mechanics (4 units)

Course Description: Tensor formulation of the field equations for continuum mechanics, including large deformation effects. Invariance and symmetry requirements. Introduction to nonlinear thermoelasticity and thermodynamics. Solution of three-dimensional problems. Selected topics.

Prerequisite(s): ECI 201.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 211A – Advanced Matrix Structural Analysis (4 units)

Course Description: Matrix structural analysis for automated analysis of structures using computers. Application of matrix analysis techniques to complex problems in structural engineering arising from soil-structure interactions, three-dimensional effects, and nonlinear material response.

Prerequisite(s): ECI 130; or equivalent or consent of instructor.

Learning Activities: Lecture 4 hour(s)

Grade Mode: Letter.

ECI 211B – Nonlinear Structural Analysis (4 units)

Course Description: Geometric and material nonlinear response of framed structures, and methods for computational simulation of such response. Applications of these concepts and techniques to structural design within modern performance assessment frameworks and software platforms.

Prerequisite(s): ECI 211A; or equivalent or consent of instructor.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 212A – Finite Element Procedures in Applied Mechanics (4 units)

Course Description: Weighted-residual and Rayleigh-Ritz methods. Weak/variational formulation and development of discrete equations using finite element approximations. Application to one- and two-dimensional problems (heat conduction).

Prerequisite(s): EAD 115 or (MAT 128A, MAT 128B (can be concurrent)).

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 212B – Finite Elements: Application to Linear & Non-Linear Structural Mechanics Problems (4 units)

Course Description: Application to linear and nonlinear structural mechanics problems. Linear elasticity, weak form, and finite element approximation. Incompressible media problems. Non-linear problems with material nonlinearity.

Prerequisite(s): ECI 212A.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 213 – Structural Dynamics (4 units)

Course Description: Analysis of structures subjected to dynamic loading; single and multi-degree of freedom systems; response spectrum analysis; numerical methods for analysis of linear systems.

Prerequisite(s): ECI 138; Or equivalent or consent of instructor.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 214 – Probabilistic Seismic Hazard Analysis & Design Ground Motions (4 units)

Course Description: Probabilistic seismic hazard analysis for use in developing design spectra and for seismic risk analyses, including the development of earthquake ground motion time series for use in dynamic analyses of structures.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 224 – Structural Reliability Analysis (4 units)

Course Description: Review of probability theory (probability distributions, conditional probability, functions of random variables); component reliability analysis (exact solutions, FORM, SORM); system reliability analysis (series systems, parallel systems, general systems); simulation methods (Monte Carlo simulation, variance reduction techniques); probabilistic codified design and reliability-based design; applications to earthquake and wind engineering.

Prerequisite(s): Highly recommended, but not required, that students have taken a graduate/undergraduate level course in Matrix and/or Indeterminate Structural Analysis and an undergraduate course in Probability Theory.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 225 – Random Vibrations (4 units)

Course Description: Probability theory; stochastic processes/random fields (time/frequency domain description, stationarity, mean square calculus, multivariate processes); response of linear systems under stochastic excitations (single-/multi-DOF systems, time/frequency domain, state space approach); reliability-based structural design (first-excursion and fatigue failures); applications to earthquake and wind engineering.

Prerequisite(s): Graduate level course in (deterministic) Structural Dynamics such as ECI 213 required (can be concurrent).

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 232 – Advanced Topics in Concrete Structures (4 units)

Course Description: Ductility of reinforced concrete; strength of two-way slabs; modified compression field theory.

Prerequisite(s): ECI 130; ECI 135; ECI 138; graduate standing.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 233 – Advanced Design of Steel Structures (4 units)

Course Description: Review of Load and Resistance Factor Design (LRFD); design of indeterminate systems; moment frames and bracing systems; connection design; seismic design of steel structures; direct analysis method for stability design; and performance assessment of steel structures.

Prerequisite(s): (ECI 130 or ECI 131); ECI 132.

Learning Activities: Lecture 4 hour(s).

Enrollment Restriction(s): Open to graduate students only.

Grade Mode: Letter.

ECI 234 – Prestressed Concrete (4 units)

Course Description: Survey of methods and applications; prestressing materials and systems; prestress losses; flexural design; design for shear and torsion; deflection computation and control; continuous beams and indeterminate structures; floor systems; partial prestressing; design of compression members; strut-and-tie models.

Prerequisite(s): ECI 135; (ECI 130 or ECI 131).

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 235 – Cement Composites (4 units)

Course Description: Applications of cement composites; materials selection and proportioning; component and composite properties; hydration reactions and microstructure development; mechanisms of failure; nondestructive test methods; fiber reinforcement; concrete durability; novel reinforcing materials; ferrocement; repair and retrofit technologies; applications to structural design.

Prerequisite(s): ENG 104 or ENG 104V.

Learning Activities: Lecture 3 hour(s), Laboratory 3 hour(s).

Grade Mode: Letter.

ECI 236 – Design of Fiber Reinforced Polymer Composite Structures (4 units)

Course Description: Basics of mechanics and design of polymer matrix composites: composite classification, manufacturing process, micromechanical property determination, classical lamination theory, strength theories, first-ply-failure, test methods, design practice, strengthening and retrofitting of existing reinforced concrete structures.

Prerequisite(s): ECI 135.

Learning Activities: Lecture 3 hour(s), Laboratory 3 hour(s).

Grade Mode: Letter.

ECI 237 – Bridge Design (4 units)

Course Description: Bridge types, behavior and construction characteristics; design philosophy, details according to Caltrans and American Association of State Highway and Transportation Officials codes, principles; seismic design and retrofit of concrete bridges; modern bridges using advanced fiber reinforced polymer composites; fieldtrip required.

Prerequisite(s): ECI 130; ECI 135; ECI 234 recommended.

Learning Activities: Lecture 4 hour(s).

Enrollment Restriction(s): Open to Graduate Students only.

Grade Mode: Letter.

ECI 238 – Performance-Based Seismic Engineering (4 units)

Course Description: Modern seismic design; performance-based seismic design; seismic hazard; seismic demands: linear and nonlinear procedures; performance assessment: deterministic and probabilistic procedure; review of FEMA-350, FEMA-356, ATC-40 and other performance-based guidelines.

Prerequisite(s): ECI 138; ECI 213.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 239 – Design of Materials & Systems for Sustainability (4 units)

Course Description: Effects on environmental impacts from materials selection and design in the built environment. Material mechanics, design constraints, and life cycle assessment in the development of “greener” materials and systems. Design of engineered materials through selecting constituents & processing techniques and the influence on mechanical properties, microstructure, and environmental impacts. Role of materials in the environmental impacts of buildings, infrastructure, and other systems.

Prerequisite(s): ENG 104 C or ENG 104V C or better; or consent of instructor.

Learning Activities: Lecture 4 hour(s).

Enrollment Restriction(s): Restricted to Graduate Students.

Grade Mode: Letter.

ECI 240 – Water Quality (4 units)

Course Description: Quality requirements for beneficial uses of water. Hydrologic cycle of quality. Hydromechanics in relation to quality of surface and groundwaters; transport and fate of waterborne pollutants. Heat budget for surface waters; predictive methods; introduction to water quality modeling.

Prerequisite(s): ECI 141; ECI 142.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 241 – Environmental Reactive Chemical Transport Modeling (4 units)

Course Description: Modeling of reactive chemical transport in air and water including kinetic reactions, equilibrium reactions, and phase partitioning. Emphasis on numerical solution schemes and programming techniques to provide deeper insight into model performance and limitations.

Prerequisite(s): (CHE 002A or CHE 002B or ECI 149N); or equivalent.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 242 – Air Quality (4 units)

Course Description: Factors determining air quality. Effects of air pollutants. Physical and chemical fundamentals of atmospheric transport and reaction. Introduction to dispersion modeling.

Prerequisite(s): (ENG 105; ECI 141N; ECI 149); or equivalents.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 243A – Water & Waste Treatment (4 units)

Course Description: Characteristics of water and airborne wastes; treatment processes and process kinetics; treatment system design.

Prerequisite(s): ECI 148A; or the equivalent.

Learning Activities: Lecture 4 hour(s).

Enrollment Restriction(s): Open to graduate majors only.

Grade Mode: Letter.

ECI 243B – Biological Treatment of Wastewater (4 units)

Course Description: Regulations; microbiology and kinetics of engineered biological processes; aeration; and activated sludge.

Prerequisite(s): ECI 243A.

Learning Activities: Lecture 4 hour(s).

Enrollment Restriction(s): Open to graduate majors only.

Grade Mode: Letter.

ECI 243C – Biological Treatment of Wastewater (4 units)

Course Description: Biological treatment of wastewater using fixed film, hybrid, digestion, and biological nutrient removal processes.

Prerequisite(s): ECI 243A; ECI 243B.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 243L – Pilot Plant Laboratory (4 units)

Course Description: Laboratory investigation of physical, chemical, and biological processes for water and wastewater treatment.

Prerequisite(s): ECI 243A; ECI 243B (can be concurrent); or consent of instructor. Graduate standing.

Learning Activities: Lecture 1 hour(s), Discussion 1 hour(s), Laboratory 6 hour(s).

Enrollment Restriction(s): Open to graduate majors only.

Grade Mode: Letter.

ECI 244A – Life Cycle Assessment for Sustainable Engineering (4 units)

Course Description: Life cycle assessment methodology. Emphasis on applications to infrastructure and energy systems. Life cycle design, life cycle cost methods, other tools from industrial ecology, and links to policy.

Learning Activities: Lecture 4 hour(s).

Enrollment Restriction(s): Enrollment restricted to graduate students.

Credit Limitation(s): Not open to students who have taken ECI 244.

Cross Listing: EGG 201.

Grade Mode: Letter.

ECI 244B – Advanced Methods in Industrial Ecology (4 units)

Course Description: Implementation, interpretation, and methodological issues and advances in life cycle assessment and other complementary methods from the field of Industrial Ecology with a focus on use in research.

Prerequisite(s): ECI 244A; or consent of instructor.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 245A – Applied Environmental Chemistry: Inorganic (4 units)

Course Description: Chemistry of natural and polluted waters. Topics include chemical, kinetic and equilibrium principles, redox reactions, gas solution and solid-solution equilibria, thermodynamics, carbonate systems, coordination chemistry, interfacial phenomena.

Prerequisite(s): ENG 105; ECI 140; CHE 002B; or the equivalent of CHE 002B; CHE 002C or CHE 107A recommended.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Grade Mode: Letter.

ECI 245B – Applied Environmental Chemistry: Organic (4 units)

Course Description: Transport and transformation of organic chemicals in the environment. Topics include application of thermodynamics to predict solubility and activity coefficients; distribution of organic chemicals between the aqueous phase and air, solvent, or solid phases; chemical, photochemical and biological transformation reactions.

Prerequisite(s): CHE 128A; CHE 128B; CHE 128C; or the equivalent; CHE 002C or CHE 107A recommended.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Grade Mode: Letter.

ECI 247 – Aerosols (4 units)

Course Description: Behavior of airborne particles including particle formation, modification, and removal processes.

Prerequisite(s): ENG 103; ENG 105; ECI 141; ECI 149N.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 247L – Aerosols Laboratory (4 units)

Course Description: Methods of generation and characterization of aerosols. Detailed topics may include flow rate measurement, aerosol generation, aerosol collection, ions measurement, metals measurement, and carbon measurement.

Prerequisite(s): ECI 247.

Learning Activities: Lecture 2 hour(s), Laboratory 6 hour(s).

Repeat Credit: May be repeated 1 time(s).

Grade Mode: Letter.

ECI 248A – Environmental Health Engineering (4 units)

Course Description: Principles and practices of environmental health engineering. Identification, evaluation, and management of environmental factors that impact public health with an emphasis on viruses and waterborne pathogens. Wastewater-based epidemiology, quantitative microbial and chemical risk assessment, and the removal and inactivation of pathogens in water and wastewater treatment.

Prerequisite(s): ECI 243A; or consent of instructor.

Learning Activities: Lecture 4 hour(s).

Enrollment Restriction(s): Pass One restricted to graduate students.

Grade Mode: Letter.

ECI 249 – Probabilistic Design & Optimization (4 units)

Course Description: Design by optimization for probabilistic systems, decision theory, the value of information, probabilistic linear programming, probabilistic dynamic programming, nonlinear probabilistic optimization. Applications in civil engineering design, project evaluation, and risk management.

Prerequisite(s): ECI 114; ECI 153; ENG 106; or equivalents.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 251 – Transportation Demand Analysis (4 units)

Course Description: Procedures used in urban travel demand forecasting. Principles and assumptions of model components (trip generation, trip distribution, model split). New methods of estimating travel demand. Computer exercises using empirical data to calibrate models and forecast travel demand.

Prerequisite(s): ECI 114; or the equivalent.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 252 – Sustainable Transportation Systems (4 units)

Course Description: Freight transportation systems, with optimization model applications beyond freight including mobility, autonomous vehicles, electrification, and planning. Evaluation of freight improvement strategies including operations, infrastructure, management, and vehicle technologies. Analysis of private and system impacts and environmental and social issues of freight activity such as traffic, behaviors, logistics, and e-commerce.

Prerequisite(s): ECI 251; or consent of instructor.

Learning Activities: Lecture 4 hour(s).

Enrollment Restriction(s): Open to graduate students only.

Grade Mode: Letter.

ECI 253 – Dynamic Programming & Multistage Decision Processes (4 units)

Course Description: Operations research. Optimization techniques with a focus on dynamic programming in treating deterministic, stochastic, and adaptive multistage decision processes. Brief review of linear programming and non-linear programming. Applications in transportation networks and other civil infrastructure systems.

Prerequisite(s): MAT 021C; MAT 022A; programming course; EAD 115 recommended.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 254 – Exploring Data from Built Environment Using R (4 units)

Course Description: Introduction to modern data science, specifically data acquisition, exploratory data analysis, visualization, and beginning data analysis using R. Emphasizes computational reasoning and working with tabular and non-standard data. Focus will be on data generated in the built environment.

Learning Activities: Lecture 3 hour(s), Laboratory 3 hour(s).

Cross Listing: GEO 279.

Grade Mode: Letter.

ECI 255 – Transit System Planning & Design (4 units)

Course Description: Transit agency and transit service operations and planning, including scheduling. Street design for transit priority. Bus and rail transit capacity and modal differences. Data used to measure transit performance.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Grade Mode: Letter.

ECI 256 – Urban Traffic Management & Control (4 units)

Course Description: Basic concepts, models, and methods related to the branch of traffic science that deals with the movement of vehicles on a road network, including travel speed, travel time, congestion concepts, car-following and hydrodynamic traffic models.

Prerequisite(s): ECI 114.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 257 – Flow in Transportation Networks (4 units)

Course Description: Elements of graph theory, a survey of pertinent optimization techniques, extremal principles in network flow problems, deterministic equilibrium assignment, stochastic equilibrium assignment, extensions of equilibrium assignments and dynamic transportation network assignment.

Prerequisite(s): ECI 153; ECI 161 or ECI 256 recommended.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 259 – Asphalt & Asphalt Mixes (4 units)

Course Description: Asphalts and asphalt mix types and their use in civil engineering structures, with primary emphasis on pavements. Asphalt, aggregate properties and effects on mix properties. Design, construction, recycling. Recent developments and research.

Prerequisite(s): ECI 179; or consent of instructor.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 260 – Sediment Transport (4 units)

Course Description: Sediment transport in hydrologic systems. Process-oriented course which will emphasize how sediment moves and the physical processes that affect sediment transport. Field trip.

Prerequisite(s): ECI 141; or equivalent.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 261 – Colloids in Soil & Water (4 units)

Course Description: Colloid occurrence, properties, behavior in different environments, and transport mechanisms in water and soils. Emphasis on their role in water contamination.

Prerequisite(s): CHE 002B; (ENG 103 or ECI 100); upper division or graduate standing.

Learning Activities: Lecture 4 hour(s).

Enrollment Restriction(s): Pass One restricted to graduate standing; Pass Two restricted to upper division standing or graduate standing.

Grade Mode: Letter.

ECI 262 – Turbulent Land-Water-Atmosphere Interactions in the Atmospheric Boundary Layer (4 units)

Course Description: Atmospheric boundary layer and the associated thermodynamics, surface energy balance partitioning, equations of motion for the atmospheric boundary layer, turbulent scalar (e.g., heat, water vapor, pollution, etc.) transport equations for stratified flow, atmospheric stability, land-water-atmosphere interactions, similarity relations, modeling parameterizations, and field data analysis.

Prerequisite(s): MAT 022B; ECI 100; ECI 141; or consent of instructor.

Learning Activities: Lecture 4 hour(s).

Enrollment Restriction(s): Open to graduate students only.

Grade Mode: Letter.

ECI 263 – Evolutionary Algorithms (4 units)

Course Description: Engineering systems design via approximate optimization of simulation models. Local vs. global search. Genetic algorithms, evolutionary strategies, genetic programming. Multi-objective methods. Parameter sensitivity and convergence assessment. Surrogate modeling.

Prerequisite(s): ECI 153 C or better; or consent of instructor. Computer programming experience required.

Learning Activities: Lecture 4 hour(s).

Enrollment Restriction(s): Open to Graduate Students.

Grade Mode: Letter.

ECI 264A – Transport, Mixing & Water Quality in River & Lakes (4 units)

Course Description: Principal causes of mixing and transport in rivers, lakes and reservoirs, and their impacts on water quality. Case studies of specific lakes and rivers.

Prerequisite(s): ECI 141; ECI 240.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 264B – Transport, Mixing & Water Quality in Estuaries & Wetlands (4 units)

Course Description: Principal causes of mixing and transport in estuaries and wetlands, and their impacts on water quality. Topics include advection/diffusion; tides; transverse mixing; longitudinal dispersion; sediment transport; nutrient cycling; computer modeling of estuaries. Case studies of specific systems.

Prerequisite(s): ECI 141; ECI 240.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 265 – Stochastic Hydrology & Hydraulics (4 units)

Course Description: Physics-based stochastic methods in modeling hydrologic and hydraulic processes; theory for modeling hydrologic-hydraulic governing equations as stochastic partial differential equations applied to various hydrologic-hydraulic processes under uncertainty, including transport, open channel flow, overland flow, soil water flow, and groundwater.

Prerequisite(s): ECI 266; or consent of instructor.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 266 – Applied Stochastic Methods in Engineering (4 units)

Course Description: Stochastic processes classification; Gaussian random fields; stochastic calculus in mean square; Ito and Stratonovich stochastic differential equations; Fokker-Planck equation; stochastic differential equations with random coefficients.

Prerequisite(s): ECI 114 or MAT 131 or STA 130A or STA 131A or MAT 118A (can be concurrent).

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 267 – Water Resource Management (4 units)

Course Description: Engineering, institutional, economic, and social basis for managing local and regional water resources. Examples in the context of California's water development and management. Uses of computer modeling to improve water management.

Prerequisite(s): ECI 114; ECI 142; or consent of instructor.

Learning Activities: Lecture 4 hour(s).

Cross Listing: GEO 212.

Grade Mode: Letter.

ECI 268 – Infrastructure Economics (4 units)

Course Description: Economics applied to infrastructure engineering planning, operations, maintenance, and management problems; microeconomic and macroeconomic theories; benefit-cost analysis; effect of uncertainty; optimization economics; non-classical economics; public finance.

Prerequisite(s): (ECN 001A or ECN 001AY or ECN 001AV); ENG 106; or the equivalent.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 269 – Transportation-Air Quality: Theory & Practice (4 units)

Course Description: Health and regulatory aspects of airborne pollutants. Principles of modeling vehicle emissions. Conformity issues and the regulatory framework. Regional and micro-scale modeling.

Prerequisite(s): ECI 149; or the equivalent.

Learning Activities: Lecture 3 hour(s), Laboratory 3 hour(s).

Grade Mode: Letter.

ECI 270 – Advanced Water Resources Management (3 units)

Course Description: Discussion of technical papers related to planning theory, system maintenance, regionalization, multi-objective methods, risk analysis, institutional issues, pricing model application, economic development, forecasting, operations, and other topics.

Prerequisite(s): ECI 153; ECI 267; or the equivalent.

Learning Activities: Lecture 3 hour(s).

Grade Mode: Letter.

ECI 272N – Contaminant Fate & Transport in Porous Media (4 units)

Course Description: Solute and colloid mass transport processes in porous media. Characterizing and quantifying physical processes of advection, diffusion/dispersion, sorption, as well as basic biogeochemical reactions.

Colloid-facilitated transport in porous media. Analytical and numerical solutions to the reactive advection-dispersion equation in Eulerian and Lagrangian forms with an introduction to advanced random walk models.

Prerequisite(s): ECI 144; MAT 021A; MAT 021B; MAT 021C; MAT 022A; MAT 022B; Ability to program.

Learning Activities: Lecture 4 hour(s).

Enrollment Restriction(s): Open to upper division and graduate students only.

Grade Mode: Letter.

ECI 273 – Water Resources Systems Engineering (4 units)

Course Description: Planning and management of water resource systems. Deterministic and stochastic simulation and optimization techniques. Capacity design and operation of reservoir systems for water supply, hydropower, flood control, and environmental objectives.

Prerequisite(s): ECI 114; ECI 153; or the equivalent.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 274 – Introduction to Turbulence (4 units)

Course Description: Fundamental theory, statistics, analysis tools and models for turbulence and turbulent flows. Practical skills related to the analysis and study of turbulence.

Prerequisite(s): MAT 022B; ECI 100; ECI 141; or consent of instructor.

Learning Activities: Lecture 4 hour(s).

Enrollment Restriction(s): Open to graduate students only.

Grade Mode: Letter.

ECI 275 – Hydrologic Time-Series Analysis (4 units)

Course Description: Application of statistical methods for analysis and modeling of hydrologic series. Statistical simulation and prediction of hydrologic sequences using time series methodology.

Prerequisite(s): ECI 114; ECI 142.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 276 – Watershed Hydrology (4 units)

Course Description: Analysis and mathematical modeling of hydrologic processes taking place in a watershed. Precipitation analysis and modeling. Theory of overland flow and its kinematic wave approximation. Analysis and modeling of saturated and unsaturated subsurface flow processes taking place on a hill slope.

Prerequisite(s): ECI 142; or the equivalent.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 277A – Computational River Mechanics I (4 units)

Course Description: Unsteady open channel flows, computation of water surface profiles, shallow water equations, St. Venant equations, method of characteristics, finite difference methods, stability and accuracy of explicit and implicit schemes, flood routing in simple and compound channels, advection of plumes.

Prerequisite(s): EAD 115 (can be concurrent); ECI 141 (can be concurrent).

Learning Activities: Lecture 4 hour(s).

Credit Limitation(s): Not open for credit to students who have taken ECI 277.

Grade Mode: Letter.

ECI 277B – Computational River Mechanics II (4 units)

Course Description: Open channel flows, physical aspects of river mechanics, formulation of depth-averaged equations, boundary conditions, coordinates transformation and grid generation, finite-difference solution techniques, applications to two-dimensional momentum and pollutant transport in rivers.

Prerequisite(s): ECI 277A.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 278 – Hydrodynamics (3 units)

Course Description: Perturbation methods. Basic water waves. Governing equations for fluid motion on a rotating earth. Rotation effects, vorticity dynamics, Ekman layer. Stratification effects, internal waves and turbulent mixing. Combined effects.

Prerequisite(s): ECI 141.

Learning Activities: Lecture 3 hour(s).

Grade Mode: Letter.

ECI 279 – Advanced Mechanics of Fluids (4 units)

Course Description: Rotational flows. Navier-Stokes equations and solutions for laminar flow; boundary layer equations and solution techniques. Nature of turbulence. Reynolds equations. Introduction to turbulence modeling.

Prerequisite(s): ECI 141.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 280A – Nonlinear Finite Elements for Elastic-Plastic Problems (4 units)

Course Description: State of the art finite element methods and tools for elasticplastic problems, including computational techniques based on the finite element method and the theory of elastoplasticity.

Prerequisite(s): Consent of instructor.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 280B – Nonlinear Dynamic Finite Elements (4 units)

Course Description: State of the art computational methods and tools for analyzing linear and nonlinear dynamics problems.

Prerequisite(s): Consent of instructor.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 281A – Advanced Soil Mechanics (4 units)

Course Description: Consolidation and secondary compression. Preloading and wick drains. Seepage and seepage pressures. Filtration, drainage, and dewatering. Shear strength: friction, cohesion, dilatancy and critical states.

Prerequisite(s): ECI 171.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 281BN – Engineering Geology (4 units)

Course Description: Principles of geology in engineering design, construction, and natural hazards. Study of geologic setting, geologic processes, properties of geologic materials and influence on safety, constructability, economic feasibility, environmental impact, and performance.

Learning Activities: Lecture 4 hour(s).

Enrollment Restriction(s): Open to graduate students only.

Grade Mode: Letter.

ECI 281C – Integrated Site Characterization (4 units)

Course Description: Integrated site characterization using field and laboratory techniques. Applied within context of slope stability analysis as a representative design problem.

Prerequisite(s): ECI 281A; or consent of instructor.

Learning Activities: Lecture 4 hour(s).

Enrollment Restriction(s): Open to graduate students only or consent of instructor.

Credit Limitation(s): Not open for credit to students who have taken ECI 281B.

Grade Mode: Letter.

ECI 282 – Pavement Design & Rehabilitation (4 units)

Course Description: Advanced pavement design and structural/functional condition evaluation for concrete and asphalt pavements. Highways, airfields, port facilities; new facilities, rehabilitation, reconstruction. Mechanistic-empirical procedures, materials, climate and traffic characterization. Use of current design methods; recent developments and research.

Prerequisite(s): ECI 179; or consent of instructor.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 283 – Physico-Chemical Aspects of Soil Behavior (4 units)

Course Description: Study of the geotechnical behavior of soils considering formation, transport, mineralogy, soil-fluid-electrolyte systems, surface tension, particle mechanics, shape, fabric, and structure. Laboratories demonstrate effects of fundamental interparticle forces (contact, Van Der Waals, capillarity and chemical).

Prerequisite(s): ECI 171.

Learning Activities: Lecture 3 hour(s), Laboratory 3 hour(s).

Grade Mode: Letter.

ECI 284 – Theoretical Geomechanics (4 units)

Course Description: Elasticity, plasticity, micromechanics, coupled behavior and large deformations for geomaterials. Prediction of stress-strain-volume change behavior of geomaterials. Monotonic and cyclic loading, anisotropy, bifurcation of deformation.

Prerequisite(s): ECI 171.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

ECI 285 – Advanced Topics in Concrete Pavement Engineering & Materials (4 units)

Course Description: Advances in concrete pavements engineering and materials, current and future needs. Strategies to reduce global warming potential through optimizing structural design and enhancing the durability of concrete pavements. Topics include structural design optimization strategies, mixture design optimization, implementation of performance-based specifications for concrete pavements, use of supplementary cementitious materials, fibers, nanomaterials, admixtures.
Learning Activities: Lecture 4 hour(s).
Grade Mode: Letter.

ECI 286 – Advanced Foundation Design (4 units)

Course Description: Design and analysis of pile and pier foundations, including seismic effects; deep excavation systems; tie-back, nailing, and anchor systems; coffer dams; loads on buried conduits; ground modification techniques; and other related topics.
Prerequisite(s): ECI 173.
Learning Activities: Lecture 4 hour(s).
Grade Mode: Letter.

ECI 287 – Geotechnical Earthquake Engineering (4 units)

Course Description: Characteristics and estimation of earthquake ground motions; wave propagation and local site response; liquefaction potential and remediation; residual strength and stability considerations; ground deformations; dynamic soil-structure interaction.
Prerequisite(s): ECI 138; ECI 281A.
Learning Activities: Lecture 4 hour(s).
Grade Mode: Letter.

ECI 288 – Earth & Rockfill Dams (4 units)

Course Description: Site selection; design considerations; layout; seismic effects including considerations of fault movements; construction; environmental considerations, instrumentation; maintenance remediation and retrofit of existing dams.
Prerequisite(s): ECI 281A; ECI 281B (can be concurrent).
Learning Activities: Lecture 4 hour(s).
Grade Mode: Letter.

ECI 289A – Selected Topics in Civil Engineering: Environmental Engineering (1-5 units)

Course Description: Directed group study in Environmental Engineering.
Prerequisite(s): Consent of instructor.
Learning Activities: Variable.
Repeat Credit: May be repeated.
Grade Mode: Letter.

ECI 289B – Selected Topics in Civil Engineering: Hydraulics & Hydrologic Engineering (1-5 units)

Course Description: Directed group study in Hydraulics & Hydrologic Engineering.
Prerequisite(s): Consent of instructor.
Learning Activities: Variable.
Repeat Credit: May be repeated.
Grade Mode: Letter.

ECI 289C – Selected Topics in Civil Engineering: Engineering Planning (1-5 units)

Course Description: Directed group study in Engineering Planning.
Prerequisite(s): Consent of instructor.
Learning Activities: Variable.
Repeat Credit: May be repeated.
Grade Mode: Letter.

ECI 289D – Selected Topics in Civil Engineering: Geotechnical Engineering (1-5 units)

Course Description: Directed group study in Geotechnical Engineering.
Prerequisite(s): Consent of instructor.
Learning Activities: Variable.
Repeat Credit: May be repeated.
Grade Mode: Letter.

ECI 289E – Selected Topics in Civil Engineering: Structural Engineering (1-5 units)

Course Description: Directed group study in Structural Engineering.
Prerequisite(s): Consent of instructor.
Learning Activities: Variable.
Repeat Credit: May be repeated.
Grade Mode: Letter.

ECI 289F – Selected Topics in Civil Engineering: Structural Mechanics (1-5 units)

Course Description: Directed group study in Structural Mechanics.
Prerequisite(s): Consent of instructor.
Learning Activities: Variable.
Repeat Credit: May be repeated.
Grade Mode: Letter.

ECI 289G – Selected Topics in Civil Engineering: Transportation Engineering (1-5 units)

Course Description: Directed group study in Transportation Engineering.
Prerequisite(s): Consent of instructor.
Learning Activities: Variable.
Repeat Credit: May be repeated.
Grade Mode: Letter.

ECI 289H – Selected Topics in Civil Engineering: Transportation Planning (1-5 units)

Course Description: Directed group study in Transportation Planning.
Prerequisite(s): Consent of instructor.
Learning Activities: Variable.
Repeat Credit: May be repeated.
Grade Mode: Letter.

ECI 289I – Selected Topics in Civil Engineering: Water Resources Engineering (1-5 units)

Course Description: Directed group study in Water Resources Engineering.
Prerequisite(s): Consent of instructor.
Learning Activities: Lecture, Laboratory, Lecture/Lab.
Repeat Credit: May be repeated.
Grade Mode: Letter.

ECI 290 – Seminar (1 unit)

Course Description: Discussion of current graduate research, and guest lectures on recent advances. Oral presentation of individual study.

Required of graduate degree candidates.

Learning Activities: Seminar 1 hour(s).

Grade Mode: Satisfactory/Unsatisfactory only.

ECI 290C – Graduate Research Group Conference (1 unit)

Course Description: Research problems, progress, and techniques in civil engineering.

Learning Activities: Discussion 1 hour(s).

Repeat Credit: May be repeated.

Grade Mode: Satisfactory/Unsatisfactory only.

ECI 291 – Projects for Environmental & Water Resources (4 units)

Course Description: Capstone independent literature-based research project. Project development, reading and mining the literature, strategies and best-practices for writing and oral communication.

Prerequisite(s): Consent of instructor.

Learning Activities: Lecture 2 hour(s), Project 2 hour(s)

Enrollment Restriction(s): Open to Graduate Students only.

Grade Mode: Satisfactory/Unsatisfactory only.

ECI 292A – Geotechnical Professional Practice 1 (1 unit)

Course Description: Geotechnical practice issues that affect the delivery of technical solutions for geotechnical projects, including business and management practices, contract documents, legal constraints, public policy and societal concerns, ethics, and professional development. Part 1 of three part series that includes a capstone project.

Prerequisite(s): Consent of instructor.

Learning Activities: Lecture 1 hour(s).

Enrollment Restriction(s): Open to graduate students only.

Grade Mode: Letter.

ECI 292B – Geotechnical Professional Practice 2 (1 unit)

Course Description: Geotechnical practice issues that affect the delivery of technical solutions for geotechnical projects, including business and management practices, contract documents, legal constraints, public policy and societal concerns, ethics, and professional development. Part 2 of three part series that includes a capstone project.

Prerequisite(s): ECI 292A; or consent of instructor.

Learning Activities: Lecture 1 hour(s).

Enrollment Restriction(s): Open to graduate students only.

Grade Mode: Letter.

ECI 292C – Geotechnical Professional Practice 3 (2 units)

Course Description: Geotechnical practice issues that affect the delivery of technical solutions for geotechnical projects, including business and management practices, contract documents, legal constraints, public policy and societal concerns, ethics, and professional development. Part 3 of three part series that includes a capstone project.

Prerequisite(s): ECI 292B; or consent of instructor.

Learning Activities: Lecture 2 hour(s).

Enrollment Restriction(s): Open to graduate students only.

Grade Mode: Letter.

ECI 295A – Engineering Education I (2 units)

Course Description: Overview of the discipline of engineering education. One course in a three-course series.

Learning Activities: Lecture/Discussion 2 hour(s).

Grade Mode: Letter.

ECI 295B – Engineering Education II - DEI (2 units)

Course Description: Diversity, equity, inclusion and justice in engineering education. One course in a three-course series.

Learning Activities: Lecture/Discussion 2 hour(s).

Grade Mode: Letter.

ECI 295C – Engineering Education III (2 units)

Course Description: Designing engineering lessons and modules for an academic or professional audience. One course in a three-course series.

Learning Activities: Lecture/Discussion.

Grade Mode: Letter.

ECI 296 – Topics in Water & Environmental Engineering (1 unit)

Course Description: Seminars presented by visiting lecturers, UC Davis faculty, and graduate students.

Prerequisite(s): Graduate standing; or consent of instructor.

Learning Activities: Seminar 2 hour(s).

Enrollment Restriction(s): Open to graduate students only.

Repeat Credit: May be repeated.

Grade Mode: Satisfactory/Unsatisfactory only.

ECI 298 – Group Study (1-5 units)

Course Description: Group study.

Prerequisite(s): Consent of instructor.

Learning Activities: Variable.

Grade Mode: Satisfactory/Unsatisfactory only.

ECI 299 – Research (1-12 units)

Course Description: Research.

Learning Activities: Variable.

Grade Mode: Satisfactory/Unsatisfactory only.

ECI 390 – The Teaching of Civil Engineering (1 unit)

Course Description: Participation as teaching assistant or associate-in in a designated engineering course. Methods of leading discussion groups or laboratory sections, writing and grading quizzes, use of laboratory equipment, and grading laboratory reports.

Prerequisite(s): Meet qualifications for teaching assistant and/or associate-in in Civil Engineering.

Learning Activities: Discussion 1 hour(s).

Repeat Credit: May be repeated 9 unit(s).

Grade Mode: Satisfactory/Unsatisfactory only.