INTRODUCTION

The primary goal of the Civil and Environmental Engineering department’s degree program is to provide students with the educational background and tools required for them to excel in their intended profession in Civil Engineering. The areas of focus in the civil engineering program are structural, geotechnical, hydraulic, environmental, construction, transportation and architectural engineering. Most course topics are well integrated with computer-aided analysis and design tools.

The undergraduate engineering program is designed to impart knowledge of mathematics and natural sciences to students so that they learn to use the forces of nature and materials economically, while maintaining engineering ethics and high professional standards.

One of the major objectives of this program is to provide design experience to students gradually from the very beginning years until they graduate, through a variety of courses. During this time, they also learn about safety, reliability, ethics, and socially and globally sensitive problems.

The graduate engineering program is designed for specialization in the areas (also called tracks) of construction, environmental, geotechnical and structural engineering.

LEARNING GOALS AND STUDENT LEARNING OUTCOMES

The following learning goals and learning outcomes have been established for students pursuing a degree in Civil and Environmental Engineering:

Program Educational Objectives

A. Technical Growth – Graduates will be successful in modern engineering practice, integrate into the local and global workforce, and contribute to the economy of California and the nation

B. Professional Skills – Graduates will continue to demonstrate the professional skills necessary to be competent employees, assume leadership roles, and have career success and satisfaction

C. Professional Attitude and Citizenship – Graduates will become productive citizens with high ethical and professional standards, who make sound engineering or managerial decisions, and have enthusiasm for the profession and professional growth

STUDENT OUTCOMES

(a) The ability to apply knowledge of mathematics, science and engineering

(b) The ability to design and conduct experiments, as well as to analyze and interpret data

(c) The ability to design a system, component, or process to meet desired needs

(d) The ability to function on multi-disciplinary teams
The ability to identify, formulate and solve engineering problems
An understanding of professional and ethical responsibility
The ability to communicate effectively
The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context
Recognize the need for and an ability to engage in life-long learning
A knowledge of contemporary issues
The ability to use the techniques, skills and modern engineering tools necessary for engineering practice
The ability to apply knowledge in at least four technical areas appropriate to civil engineering
An understanding of professional practice, e.g., management, business, public policy, leadership and professional licensing

High School Preparation
The entering freshman’s preparation should include two years of algebra, geometry, trigonometry, and one year of physics or chemistry. Students deficient in mathematics or chemistry must take special preparatory courses, which will not carry credit for the major. (See Mathematics Section for Entry Level Mathematics test and Math-Science Qualifying Examination requirements)

Transfer Students
A transfer student shall complete a minimum of 30 units in residence, 15 of which shall be taken in upper-division engineering courses. Work taken at another college or university on which a “D” (1.0) was earned may not be substituted for upper-division courses.

BACHELOR OF SCIENCE IN CIVIL ENGINEERING (129 UNITS)
The Bachelor of Science in Civil Engineering is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org. The degree includes 85 units in the major, 30 General Education units, 14 units of electives and all university requirements. When selecting courses, students need to consult with a faculty adviser. Course prerequisites are strictly enforced.

All required courses toward the degree must be taken for a letter grade. All required mathematics and science courses must be passed with a “C-” (1.7) or better. The exceptions are MATH 150A, which must be passed with a “C” (2.0) or better, and BIOL 101, which must be passed with a “D” (1.0) or better. Graduate courses are not open to undergraduate students without department approval. A GPA of 2.0 or better is required for the major.

Mathematics and Science Courses (34)

BIOL 101 Elements of Biology (3)
CHEM 115 Introductory General Chemistry (4)
MATH 150A Calculus (4)
MATH 150B Calculus (4)
MATH 250A Multivariate Calculus (4)
MATH 250B Introduction to Linear Algebra and Differential Equations (4)
PHYS 225, 225L Fundamental Physics: Mechanics and Lab (4)
PHYS 226, 226L Fundamental Physics: Electricity and Magnetism and Lab (4)
EGCE 308 Engineering Analysis (3)

Introductory Engineering Courses (9)
EGCE 201 Statics (3)
EGCE 302 Dynamics (3)
EGEE 401 Engineering Economics and Professionalism (3)

General Education Courses
Area A: Core Competencies (9 Units)
1. Oral Communication (3)
   HONR 101B, HCOM 100, 102
2. Written Communication (3)
   ENGL 101
3. Critical Thinking (3)
   HONR 101A, HCOM 235, PHIL 105, 106, PSYC 110, READ 290

Area B: Scientific Inquiry and Quantitative Reasoning (11 Units)
1. Physical Science (3)
   PHYS 225
2. Life Science (3)
   BIOL 101
3. Laboratory Experience (1)
   PHYS 225L
4. Mathematics/Quantitative Reasoning (4)
   MATH 150A
5. Implications and Explorations in Mathematics and Natural Sciences
   Not applicable for engineering majors

Area C: Arts and Humanities (12 Units)
1. Introduction to Arts (3)
   ART 101, 201A, 201B, 311, 312, DANC 101, MUS 100, 101
2. Introduction to the Humanities (3)
   Any lower-division course in this category listed in the current class schedule
3. Explorations in the Arts and Humanities (3)
   Any upper-division course in this category listed in the current class schedule
4. Origins of the World Civilizations (3)  
   HIST 110A or 110B, 210A, 210B

**Area D: Social Sciences (12 Units)**

1. Introduction to the Social Sciences (3)  
   EGCP/EGCE/EGEE 401
2. World Civilizations and Cultures  
   Not applicable for engineering majors
3. American History, Institutions and Values (3)  
   AFAM 190, AMST 201, CHIC 190, HIST 180, 190, HONR 201A
4. American Government (3)  
   HONR 201B, POSC 100
5. Explorations in Social Sciences (3)  
   Any upper-division course in this category listed in the current class schedule

**Area E: Lifelong Learning and Self Development (3 Units)**  
Not applicable for engineering majors

**Area Z: Cultural (3 Units)**  
Take at least one star (*) course in Sections C.3 and D.5

**Upper-Division Writing Requirement**  
Six units from the following courses are required and must be passed with a "C" (2.0) or better. Laboratory reports are graded on English composition, as well as content.  
EGCE 324L, 325L, 377, 428L, 431L, 463L, 465, 468

**CIVIL ENGINEERING**  
Mathematics and Science Courses (34 units)

**Introductory Engineering Courses (9 units)**

**Civil Engineering Core Courses (42 units)**

EGCE 206  Computer-Aided Architectural and Civil Engineering Drafting (1)
EGCE 214  Engineering Surveying (2)**
EGCE 214L  Engineering Surveying Laboratory (1)**
EGCE 301  Mechanics of Materials (3)
EGCE 324  Soil Mechanics (3)
EGCE 324L  Soil Mechanics Laboratory (1)
EGCE 325  Structural Analysis (3)
EGCE 325L  Structural Analysis Laboratory (1)
EGCE 377  Civil Engineering Materials Lab (1)
EGCE 408  Reinforced Concrete Design (3)
EGCE 418  Foundation Design (3)
EGCE 428  Engineering Hydraulics (3)
EGCE 428L  Engineering Hydraulics Lab (1)
EGCE 430  Structural Steel Design (3)
EGCE 432  Computer-Aided Analysis and Design in Civil Engineering (3)
EGCE 441  Environmental Engineering (3)
EGCE 468  Engineering Construction (3)
EGCE 494  Design of Civil Engineering Structures (3)**
EGCE 494L  Design of Civil Engineering Structures Laboratory (1)**

**Technical Electives in Civil Engineering (14 units minimum)**  
Before enrolling in any elective course, approval of the adviser must be obtained.  
EGCE 411, 431L, 435, 436, 463, 463L, 465, 466, 481, 482, 493, 496, 497, 499
CHEM 125*

**CIVIL ENGINEERING WITH ARCHITECTURAL ENGINEERING EMPHASIS**

Students wishing to earn an Architectural Engineering Emphasis must fulfill the requirements for the Bachelor of Science in Civil Engineering. When choosing their electives, they must consult with an adviser.

**MASTER OF SCIENCE IN CIVIL ENGINEERING (30 UNITS)**

The Master of Science degree in Civil Engineering is intended to meet the needs of students who wish to prepare for careers in areas such as construction and project management, design and analysis of complex systems (including structures, such as tall buildings and bridges), environmental engineering, geotechnical engineering, consulting and research; as well as doctoral studies.  
The program provides advanced study within the area of civil engineering and allows students to select coursework, with adviser approval, in the areas of construction engineering and management, environmental engineering, geotechnical engineering and structural engineering.

**Admission Requirements**

Students must meet the CSU requirements for admission to a master’s degree program. Please consult the Graduate Admissions section in this catalog for complete information. Applicants meeting these requirements will be admitted to the graduate program in Civil Engineering and will advance to classified standing immediately after filing an adviser-approved study plan in the Civil and Environmental
Engineering Department office. Students not meeting the above requirements may be admitted and will be required to take additional prerequisite coursework.

Any student entering the M.S. degree program without a B.S. in Civil Engineering will be required to complete deficiency courses prior to beginning coursework for the master’s degree. All deficiency courses must be completed before the final semester of coursework.

Students who possess a bachelor’s degree from a postsecondary institution where English is not the principal language should submit an iBT TOEFL score of 80 or better. The Civil and Environmental Engineering Department does not require the Graduate Record Exam (GRE).

Application Deadlines
- Refer to: fullerton.edu/ecs for application information.

Classified Standing
- Students will be advanced to classified standing and are eligible to take graduate courses for which they are qualified by meeting the following requirements.
  1. Complete all deficiency work specified by the graduate adviser with a “B-” (2.7) or better before starting graduate courses (unless approved by the chair);
  2. meet with an adviser prior to completing nine units toward the M.S. degree at CSUF to develop a study plan, which must be approved by the department chair and Office of Graduate Studies; and
  3. fulfill the university writing requirement prior to completing nine units at CSUF toward the M.S. Degree by successfully completing one of the following:
     - An upper-division writing requirement at any CSU campus
     - An upper-division writing course from another university that is equivalent to a course satisfying the CSUF Upper-Division Writing Requirement. Equivalency must be certified by the department chair
     - Cal State Fullerton Examination in Writing Proficiency (EWP)
     - CSUF upper-division or graduate-level course that is certified as meeting the writing requirement and is approved by the department chair. A grade of “C” (2.0) or better is required.

Study Plan
- The study plan consists of adviser-approved upper-division or graduate-level coursework, which must be completed with an overall grade-point average of at least 3.0. At least half the units required for the degree must be in approved graduate (500-level) courses.

Required Courses (6 units)
- EGGN 403 and an additional three-unit, adviser-approved math-oriented course, or six units adviser-approved electives (for those focusing on environmental and construction areas).

Course Tracks (15 units)
- Students are required to select a minimum of 15 units in Civil Engineering. These units may be 400- (subject to approval by the department chair) and 500-level courses and are selected according to each student’s area of interest. Coursework may focus on the following areas: Construction Engineering and Management; Geotechnical Engineering; and Structural Engineering Upon graduation, students will receive a Master’s degree in Civil Engineering. Environmental Engineering track students will receive a Master’s degree in Civil Engineering with a concentration in Environmental Engineering.

Other Courses (9 units)
- Elective units should be taken in Civil Engineering or a related engineering field and are subject to adviser approval.

Exam/Thesis/Project Option
- Subject to approval by the department head, students may select one of the following three options for final review by a department committee:
  1. Oral comprehensive examination
  2. EGCE 598 Thesis
  3. EGCE 597 Project

CONCENTRATION IN ENVIRONMENTAL ENGINEERING

Required Concentration Courses (15 units)
- EGCE 481 Solid Waste Technology and Management (3)
- EGCE 482 Liquid Waste Technology and Management (3)
- Adviser-approved Environmental Engineering courses, which may include Thesis, Project or Independent Study (9)

Electives (15 units)
- Adviser-approved electives must include a minimum of six units in non-Environmental Engineering courses.

CIVIL AND ENVIRONMENTAL ENGINEERING COURSES
- Courses are designated as EGCE in the class schedule

201 Statics (3)
206 Computer-Aided Architectural and Civil Engineering Drafting (1)

Architectural and civil engineering drawing with the aid of computer-aided drafting techniques; grading plans, engineering drawings (including standard structural, electrical and hydraulic details) of buildings, bridges, dams and civil engineering structures. Bill of Materials. (3 hours laboratory)

214 Engineering Surveying (2)


214L Engineering Surveying Laboratory (1)

Corequisite: EGCE 214. Field practice of measuring distance, difference of elevation, and horizontal and vertical angles using tapes, EDM, automatic levels, theodolites and total stations. (3 hours laboratory)

301 Mechanics of Materials (3)


302 Dynamics (3)

Prerequisites: MATH 250A, EGCE 201. Kinematics and kinetics of particles and rigid bodies, kinetics of rigid bodies in three dimension, Newton's laws, work and energy, impulse and momentum. Solution of problems using vector approach.

305 Failure of Building and Structure Due to Earthquakes and After Effects (3)

Prerequisite: one course from General Education Category B.4 or B.1. Geological aspects of earthquakes as they apply to building safety; introduction to earthquake-related problems and building damages caused by historic earthquakes. Destruction aspects of earthquakes, preparedness for large earthquakes and how to protect structural and non-structural parts of buildings. (Same as GEOL 305)

308 Engineering Analysis (3)

Prerequisites: PHYS 226 and MATH 250B or equivalent. Fundamentals and engineering applications of Fourier transforms, Laplace transforms, complex analysis, vector analysis; engineering applications. (Same as EGEE/EGGN/EGME 308)

324 Soil Mechanics (3)

Prerequisite: EGCE 301. Soil properties and soil action as related to problems encountered in engineering structures; consolidation, shear strength, stability and lateral earth pressures.

324L Soil Mechanics Laboratory (1)

Prerequisites: ENGL 101, EGCE 324. Behavior and properties of soils. Application to foundation design, liquefaction and seepage.

325 Structural Analysis (3)

Prerequisite: EGCE 301. Forces and displacements in statically determinate and indeterminate elastic structures by force and displacement methods. Approximate methods of analysis. Matrix formulation of structural analysis and computer applications. Introduction to structural design.

325L Structural Analysis Laboratory (1)

Prerequisites: ENGL 101, EGCE 325. Principles of model analysis and similitude. Influence lines for reactive and internal forces; generalized displacements of statically indeterminate structures. Nonprismatic members. (3 hours laboratory)

377 Civil Engineering Materials Laboratory (1)

Prerequisites: EGCE 324, 325. Behavior and properties of most common materials, e.g., steel, concrete, wood, masonry and asphalt. Mix design of asphalt and concrete. Determination of strain and stress using strain gages. Specimen testing according to ASTM. Material properties determination. Safety, reliability, and design considerations. (3 hours laboratory)

401 Engineering Economics and Professionalism (3)

(Same as EGCP/EGEE 401)

408 Reinforced Concrete Design (3)

Prerequisite: EGCE 325. Design for bending, shear, axial force, torsion and combined loading. Beam, columns, slab and foundation design for ultimate strength and serviceability requirements. Prestressed concrete design. Safety, reliability and cost considerations. Design project conforming to latest ACI code. Professional computer program. Not available for graduate degree credit. (2 hours lecture, 3 hours lab)

411 Structural Dynamics (3)

Prerequisites: EGCE 308, 325. Free and forced vibrations of discrete and continuous systems. Matrix formulation and normal coordinates analysis. Response of structures to impulse and earthquake loads. Application to structural design problems and comparison with code prescribed forces.

418 Foundation Design (3)

Prerequisites: EGCE 324, 408. Footings and retaining walls design. Mat and piled foundations for structures. Design project to standards of professional practice using latest codes and standards. Consideration for safety, reliability and cost.

428 Engineering Hydraulics (3)

428L Engineering Hydraulics Laboratory (1)
Prerequisites: ENGL 101, EGCE 428. Introduction to experimental hydraulics in open channel and pipe flows, including measuring discharge, depth, velocity, force and friction coefficients. Hydraulic model laws and report writing. (3 hours laboratory)

430 Structural Steel Design (3)
Prerequisite: EGCE 325. Design for bending, torsion, shear, axial forces, combined loadings. Design of built-up girders, composite construction. Design of shear and moment connections. Design project using professional practice standards. LRFD method. Safety, reliability and cost considerations. Professional computer program. Not available for graduate degree credit. (2 hours lecture, 3 hours laboratory)

431L Advanced Structural Laboratory (1)
Prerequisites: EGCE 325L, and EGCE 408 or 430. Fundamentals of earthquake engineering and soil structure interaction; design of lateral bracing for model buildings. (3 hours laboratory)

432 Computer-Aided Analysis and Design in Civil Engineering (3)

435 Design of Hydraulic Structures (3)
Prerequisite: EGCE 428. Applications of hydraulic principles to design of various structures, including spillways, energy dissipaters, outlet works, storm drains, culverts and water distribution systems. Use of computers in design process.

436 Engineering Hydrology (3)
Corequisite: EGCE 428. Hydrologic cycle with applications to hydrologic design of engineering structures. Rainfall, stream flow, ground water, surface runoff, hydrographs, flood routing, frequency distributions and design hydrographs.

441 Environmental Engineering (3)
Prerequisite: BIOL 101 or CHEM 115. Planning and controlling the environment; wastewater treatment and disposal; solid waste management; air pollution; radiation protection; housing and residential environment.

463L Precast and Prestressed Concrete Design Lab (1)
Prerequisites: EGCE 408 and EGCE 463 or equivalent. Behavior of prestressed and reinforced concrete members subjected to the different types of loadings. Observing elastic and ultimate strength behavior, deflection crack propagation and collapse. Observing prestressing operation and camber. (3 hours laboratory)

465 Planning and Control of Engineering Construction Projects (3)
Prerequisite: senior standing. Overview of construction project management; construction scheduling fundamentals: bar charts, CPM, PERT; schedule control: manual vs. computer systems, reports, schedule maintenance; cost control: code of accounts, control base, budgets, forecasting, reports, computer systems; applications in construction projects.

466 Public Transit Systems Planning and Operations (3)
Prerequisite: senior standing in Civil Engineering. Urban passenger transportation modes, paratransit, special modes, vehicles characteristics and motion, highway transit mode, rail transit mode, new concepts, transit system performance (capacity, productivity, efficiency and utilization, organization and financing).

468 Engineering Construction (3)

481 Remediation of Contaminated Soil and Groundwater (3)
Prerequisite: EGCE 441 or equivalent, or enrollment in M.S. Environmental Engineering program. Site assessment, green technologies, design for soil remediation systems and design for groundwater remediation systems. One or more sections offered online.

482 Wastewater Treatment and Water Reclamation (3)
Prerequisite: EGCE 441 or enrollment in M.S. Environmental Engineering program. Principles of anoxic, aerobic and anaerobic biological processes and treatment. Stepwise development and process design equipment selection, economic evaluation, green technologies and operating guidelines for wastewater treatment. Offered online only.

493 Structural Systems Emphasis on Highrise Structures (3)
Prerequisite: EGCE 408, 430. Structural concepts and systems for buildings and complex structures and their behavior under loads. Roof, floor, wall systems. Characteristics and design concepts of complex structures and high-rise buildings. Design project. Latest building codes and computer application. Sustainability and green building.
494 Design of Civil Engineering Structures (3)

494L Design of Civil Engineering Structures Laboratory (1)
Corequisite: EGCE 494. Design of bridges according to AASHO code. Design project to the standards of professional practice. (3 hours laboratory)

496 Architectural Design (3)
Prerequisite: EGCE 408 or 430 or senior standing or consent of instructor and department head. History of architectural design. Systems-based design process: aesthetic, functional, environmental and behavioral aspects. Urban planning and design. Case studies. Architectural design project to the standards of professional practice.

497 Senior Projects (1-3)
Prerequisites: senior standing in engineering and formal approval by adviser and department head. Independent design projects. Formal report to be submitted after completion of project work.

499 Independent Study (1-3)
Prerequisites: senior standing in engineering and formal approval by adviser and department head. Special topics in civil engineering. Formal report to be submitted after completion of independent study.

501 Analytical Methods for the Design of Civil Engineering Systems (3)
Prerequisite: graduate standing or equivalent. Applying linear and dynamic programming principles to the design of pipelines, irrigation systems, water-resources and traffic-flow control problems. Probabilistic network analysis. First order and advanced first order second moment reliability methods. Probabilistic design.

509 Theory of Plates and Shells (3)

510 The Finite Element Method (3)
Prerequisites: EGCE 517 and 533 or equivalent. Formulating finite elements for analyzing plane stress and strain problems, axisymmetric bodies, plates and shells. Conforming and non-conforming shape functions. Computer applications to complex structural systems under static and dynamic loads.

515 Solid Waste Management, System Design and Sustainability (3)
Prerequisite: EGCE 436 or equivalent, or enrollment in M.S. Environmental Engineering program. Industrial waste treatment and disposal, waste minimization, process selection, control, green technologies and resource recovery. Design of liners, gas and leachate collection and removal systems in landfills. Offered online only.

517 Theory of Elasticity (3)

532 Earthquake Engineering (3)
Prerequisites: EGCE 411 and, 533 or equivalent. Earthquake motions; response spectra; computational methods and computer applications for response of structural systems. Energy absorption capacity of materials and structural components. Soil structure interaction. Seismic design and evaluation of current building codes.

533 Matrix Methods of Structural Analysis (3)

534 Advanced Construction Methods and Techniques (3)
Prerequisites: EGCE 408, 430. Methods and equipment for constructing high-rise buildings, space structures, folded plates, shells and suspension systems. Modularization. Quality control and construction failures.

537 Groundwater and Seepage (3)
Prerequisite: EGCE 436 or equivalent. Equations governing flow of liquid in porous media. Seepage through dams and under structures, flow in confined and unconfined aquifers, steady and unsteady flow, well fields, flow nets, computer solutions, sea water intrusion, recharge, groundwater pollution.

538 Construction Methods and Equipment for Heavy Construction Engineering (3)
Prerequisites: EGCE 408, 418. Methods and equipment for constructing foundations, highways, airfields, bridges, ports, harbors, dams, nuclear power plants and industrial facilities. Quality control and construction failures.

539 Preconstruction Design Evaluation (3)
Prerequisite: EGCE 534 or equivalent. Cost benefit, preconstruction scheduling and constructability modifications in design, specifications and construction methods. Value Engineering.
544 Advanced foundation engineering (3)
Prerequisite: EGCE 418. Design foundations for earthquake loading and problematic soils; design piles and casions, ground surface subsidence, slope stability and stabilization, anchored bulkheads and dam sections.

546 Surface Water Pollution and Control (3)
Prerequisite: EGCE 436 or equivalent, or enrollment in M.S. Environmental Engineering program. Sources, quality and quantity of storm water runoff, best management practices (BMPs), system design of structural BMPs, green technologies, design for wastewater discharge into rivers, lakes and oceans. Offered online only.

549 Theory of Elastic Stability (3)
Prerequisites: EGCE 509 and 517 or equivalent. Critical buckling loads of columns, beam-columns, frames, plates and shells. Lateral stability of beams. Torsional buckling of open wall sections.

550 Major Commercial Project Development and Management (3)
Prerequisite: any 400-level management course approved by the department head. Process of major commercial project development; macroeconomics aspects; project initiation and implementation, construction management systems, schedule, cost and quality control, control of long-lead equipment and materials, construction disputes and claims, case studies.

556 Construction Cost Control, Scheduling and Planning (3)
Prerequisite: EGCE 465 or 468 or equivalent. Systems approach for estimating, scheduling, cost comparison, risk analysis and cost control. Project feasibility studies and alternative approaches. Project control, baseline establishment, cost and claim management.

557 Cost Estimating and Bidding Strategy (3)
Management and cost control of large capital projects. Capital cost estimation, value prediction and control, cost and schedule control and management of mega projects.

559 Environmental and Public Transportation Regulations (3)
Prerequisite: EGCE 441 or equivalent. Environmental regulations, clean air act, intermodal surface transportation efficiency act of 1991, Federal Transit Administration project planning guidelines, planning for public transit and environmental requirement, developing required environmental documents; procedure for major investment studies; future of public transportation. Project.

563 Advanced Prestressed and Reinforced Concrete Design (3)
Prerequisite: EGCE 408 or 463. Prestressed concrete theory. Continuous prestressed concrete members, flat plate systems, virendeel systems, application of unbounded posttensioning – theory and design. Yield line theory, limit analysis and cracking of concrete. Designing prestressed dome roof, barrel shell and hyperbolic paraboloid shell. Design project to standards of professional practice. Computer application. (2 hours lecture, 3 hours laboratory)

566 Design of Tall Buildings (4)
Prerequisites: EGCE 408 or 430; EGCE 533 or equivalent. Characteristics, design criteria and safety provisions of tall buildings. Selecting, optimizing and analyzing framing systems. Design standards, constructability, wind and seismic considerations. Design project to the standards of professional practice. Computer application.

575 Data Mining in Sustainability (3)
Expert systems and artificial intelligence techniques in construction engineering; expert systems for: safety evaluation of structures during construction, site selection, construction decision making, and construction schedule analysis; project monitoring; claims and disputes.

583 Air Pollution Control Engineering (3)
Prerequisite: EGCE 441 or enrollment in M.S. Environmental Engineering program. Sources and impacts of air pollutants, methods of sampling and analysis, air dispersion modeling, control techniques and system design for common air pollutants, climate changes, green technologies and greenhouse emission control. Offered online only.

597 Project (1-6)
Prerequisites: Classified graduate status and formal approval of Civil Engineering Graduate Committee, graduate adviser and department head.

598 Thesis (1-6)
Prerequisites: classified graduate status and formal approval of Civil Engineering Graduate Committee, graduate adviser and department head. (Maximum of 3 units per semester)

599 Independent Graduate Research (1-3)
Prerequisites: classified graduate status and formal approval of Civil Engineering Graduate Committee, graduate adviser and department head.