# CIVIL & URBAN ENGINEERING (CE-UY)

**CE-UY 496X Undergraduate Research Project in Civil and Urban Engineering (1-3 Credits)**
*Typically offered Fall, Spring, and Summer terms*
The Undergraduate Research Project in Civil and Urban Engineering involves analytical, design or experimental studies in civil or urban engineering guided by a faculty adviser. The work should explore traditional or emerging areas of civil and urban engineering. A written report is required. May be repeated for credit up to 3 credits. | Prerequisite: Junior or higher standing, cumulative GPA > 2.7, and permission of the Civil Engineering Program Adviser.
**Grading:** Satisfactory/Unsatisfactory
**Repeatable for additional credit:** Yes
**Prerequisites:** Junior or higher standing, cumulative GPA > 2.7, and permission of the Civil Engineering Program Adviser.

**CE-UY 497X Undergraduate Thesis in Civil and Urban Engineering (1-3 Credits)**
*Typically offered Fall, Spring, and Summer terms*
The Undergraduate Thesis in Civil and Urban Engineering should report the results of an original investigation. The research should explore traditional or emerging areas of civil or urban engineering. The thesis may involve experimental research, theoretical analyses, numerical simulations, or combinations thereof. The undergraduate B.S. Thesis must be conducted with faculty supervision. Students are required to submit a bound thesis to the Civil & Urban Engineering Department. Honors students may submit the same document to the Office of Undergraduate Academics to fulfill the Honor's College requirements. May be repeated for credit up to six credits. | Prerequisite(s): Junior or higher standing, cumulative GPA > 3.0, and permission of the Civil Engineering Program Adviser
**Grading:** Satisfactory/Unsatisfactory
**Repeatable for additional credit:** Yes
**Prerequisites:** Junior or higher standing, cumulative GPA > 3.

**CE-UY 1002 Introduction to Civil and Environmental Engineering (2 Credits)**
*Typically offered Fall and Spring*
This course introduces the student to the profession and practice of civil engineering and environmental engineering. Course topics include: the principal subdisciplines of civil and environmental engineering and their relationship to urban and regional infrastructure; professional ethics and the responsibilities of engineers to their profession and to the general public; communication and technical skills required for success in the discipline; and principles of sustainable development. The course includes laboratory computer-aided design, geographic information systems, and surveying. | Prerequisite: Students from other than the Civil and Urban Engineering department program must obtain permission from the CUE program adviser. | Weekly Lecture Hours: 1.5 | Weekly Lab Hours: 1.5 | Weekly Recitation Hours: 0
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** Students from other than the Civil and Urban Engineering department program must obtain permission from the CUE program adviser.

**CE-UY 2112 Structural Statics (2 Credits)**
*Typically offered Fall and Spring*
This course covers vector treatment of the static equilibrium of particles and rigid bodies. Topics: equivalent force and couple systems; distributed forces; static analysis of trusses and beams; centroid, center of gravity and moment of inertia. | Prerequisites: PH-UY 1013 or equivalent
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** PH-UY 1013 or equivalent.

**CE-UY 2122 Strength of Materials (2 Credits)**
*Typically offered Fall and Spring*
This course covers the mechanical properties of materials; the concepts of stresses and strains; stress-strain relationships; axial load, bending and transverse shear; torsion and stress; and strain transformation. | Prerequisites: CE-UY 2112 with a grade of C or better or equivalent
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** CE-UY 2112 with a grade of C or better or equivalent.

**CE-UY 2143 Analysis of Determinate Structures (3 Credits)**
*Typically offered Fall and Spring*
This course offers in-depth coverage of the basic concepts of analysis of determinate structures, topics include elastic deflections of trusses, beams and frame structures. Influence lines for statically determinate structures, and behavior of short and tall columns. Stress and strain distribution in composite beams. | Prerequisite: CE-UY 2133 with a grade of C or better; or CE-UY 2112 with a grade of C or better. Co-requisite: CE-UY 2122
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** CE-UY 2133 with a grade of C or better; or CE-UY 2112 with a grade of C or better.
**Corequisites:** CE-UY 2122.

**CE-UY 2213 Fluid Mechanics and Hydraulics (3 Credits)**
*Typically offered Fall and Spring*
The course examines the basic principles of fluid mechanics with beginning applications to hydraulic design. Topics include fluid properties, fluid statics, elementary fluid dynamics and Bernoulli equation, continuity, energy and momentum equations, and fluid kinematics. Additional topics are laminar and turbulent flow, boundary layer characteristics, drag and lift concepts (flow over immersed bodies), dimensional analysis, and fluid measurements. | Prerequisite: CE-UY 2133 or CE-UY 2112 or equivalent | Weekly Lecture Hours: 2.5 | Weekly Lab Hours: 1.5
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** CE-UY 2133 or CE-UY 2112 or equivalent.

**CE-UY 2253 Environmental Chemistry and Microbiology (3 Credits)**
*Typically offered Fall*
This course introduces students to the fundamental concepts in environmental chemistry and microbiology, and their applications to environmental engineering issues and processes. Environmental chemistry topics to be covered include redox chemistry; acid# base chemistry; alkalinity and buffers; and biochemical cycles. Environmental microbiology topics to be covered include microbial diversity, classification, and metabolism kinetics; bioremediation; and biodegradation. Students are also introduced to common chemical and microbial contaminants and pathogens in the environment. | Prerequisites: (CM-UY 1001 and CM-UY 1003) or (CM-UY 1011 and CM-UY 1013) or CHEM-UA 125, or equivalent
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** (CM-UY 1001 and CM-UY 1003) or (CM-UY 1011 and CM-UY 1013) or CHEM-UA 125, or equivalent.

**CE-UY 2313 Introduction to Transportation Systems (3 Credits)**
*Typically offered Fall*
This course focuses on the fundamental conceptual elements of transportation systems and describes the approaches used to analyze and design transportation systems. The course covers the basic material about transportation systems, the context within which they operate and a characterization of their behavior. | Prerequisite: CE-UY 1002 or Sophomore or higher standing.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** CE-UY 1002 or Sophomore or higher standing.

**CE-UY 2343 Transportation Engineering (3 Credits)**
*Typically offered Fall and Spring*
This course provides an introduction to transportation engineering. The course will cover travel demand forecasting, road user and vehicle characteristics, traffic engineering studies, engineering economic analysis, and highway design. The highway design element will focus on the basic design concepts of horizontal and vertical alignment, superelevation, and cross-section design. The course will also cover flexible pavement design, design of parking facilities, as well as bikeway and walkway design. | Prerequisites: CE-UY 1002 or Sophomore or higher standing.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** CE-UY 1002 or Sophomore or higher standing.

**CE-UY 2513 Construction Materials and Methods (3 Credits)**
*Typically offered Fall*
This course introduces students to traditional and emerging materials and methods employed in building and civil infrastructure projects. The course also addresses safety, regulation, constructability and sustainability from planning through design and construction. | Prerequisite(s): CE-UY 1002 or Sophomore or higher standing
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** CE-UY 1002 or Sophomore or higher standing.

**CE-UY 2523 Contracts and Construction Documents (3 Credits)**
*Typically offered Spring*
This course covers the documents used in design and construction, including design and construction agreements, drawings and specifications, general and special conditions and others used for procurement and construction administration. The course also examines the relationships among the owner, designers, contractors and suppliers. Students have the opportunity to discuss quality, safety and business and professional ethics. | Prerequisite: CE-UY 1002 or Sophomore or higher standing
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** CE-UY 1002 or Sophomore or higher standing.

**CE-UY 2533 Construction Project Management (3 Credits)**
*Typically offered Fall and Spring*
This course covers the fundamentals of construction project management. The students will learn to apply the basic principles and practices of construction project management, including planning, estimating, scheduling, quality, safety and leadership over the life of a construction project. | Prerequisite: CE-UY 1002 or Sophomore or higher standing
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** CE-UY 1002 or Sophomore or higher standing.

**CE-UY 3013 Computing in Civil Engineering (3 Credits)**
*Typically offered Fall and Spring*
This course aims to introduce the modern computing methods, tools, and best practices for students in civil and urban engineering. The course uses Python as the programming language for solving a series of fundamental computational problems in civil and urban engineering, such as solving linear equations, data interpolation, curve fitting, root finding, numerical differentiation and integration, probability and statistics, linear programming and optimization. The course also introduces a series of generic computation tools and best practices for the students' future study and research in computing applications in civil and urban engineering, including how to debug a program, visualize data, manage source codes, collaborative programming project management, etc. It aims at laying a solid foundation for civil and urban engineering students to better understand the modern programming workflow and utilize the computing tools. Students are first introduced with the fundamental concepts through the lecture, and then guided step-by-step via the in-class lab session in each weak. There will be multiple homework assignments and in-class quizzes for the evaluating the students' performances. | Prerequisite: (CS-UY 1113 or CS-UY 1114) and MA-UY 2034 and MA-UY 2224 and Junior or higher standing.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** (CS-UY 1113 or CS-UY 1114 or CS-UY 1133) and MA-UY 2034 and MA-UY 2224 and Junior or higher standing.

**CE-UY 3123 Dynamics of Extreme Events (3 Credits)**
*Typically offered occasionally*
This course is an introduction to the dynamics of extreme natural events and their impact on the built and human environments. The course is case based and data driven, covering scenarios including earthquakes, hurricanes, floods, fires, and heatwaves. The subject is introduced from points of view of characterization, forecasting, monitoring and condition assessment, as well as strategic planning to mitigate property and population impact. Methods used include mapping and analysis of global data resources and sensor networks and models for event prediction, as well as analytical methods and numerical simulations to understand the response of physical systems when subject to extreme conditions. | Prerequisite: PH-UY 1013 or equivalent with a grade of B or better; or PHYS-UA 11 or equivalent with a grade of B or better; or CE-UY 2133; or CE-UY 2112
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** PH-UY 1013 or equivalent with a grade of B or better; or PHYS-UA 11 or equivalent with a grade of B or better; or CE-UY 2133; or CE-UY 2112.

**CE-UY 3133 Structural Analysis (3 Credits)**
*Typically offered occasionally*
This course offers in-depth coverage of structural analysis techniques. Topics: analysis of statically determinate structures; deflection calculations using energy methods; analysis of statically indeterminate structures using superposition; influence lines; and slope deflection, moment distribution and matrix analysis of structures. Computer applications are included. | Prerequisites: MA-UY 2034 and CE-UY 2143, or equivalents.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** MA-UY 2034 and CE-UY 2143, or equivalents.

**CE-UY 3143 Steel Design (3 Credits)**
*Typically offered Fall*
This course examines structural design principles and techniques. Topics: Design of steel tension members, beams and columns; design of beam-columns; and design of bolted and welded connections for steel design. The course includes a group design project | Prerequisite: CE-UY 3183 or equivalent.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** CE-UY 3183 or equivalent.

**CE-UY 3153 Geotechnical Engineering (3 Credits)**
*Typically offered Fall and Spring*
This course is an introduction to soil mechanics and foundation engineering. Topics include origin of soils, phase relationships, classification of soils, permeability, effective stress, seepage, consolidation, shear strength, analysis of lateral earth pressure, and soil bearing capacity. | Prerequisites: (CE-UY 2133 or CE-UY 2122) and CE-UY 2213, or equivalents. | Weekly Lecture Hours: 2 | Weekly Lab Hours: 3
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** (CE-UY 2133 or CE-UY 2122) and CE-UY 2213, or equivalents.

**CE-UY 3163 Materials for the Built Environment (3 Credits)**
*Typically offered Fall and Spring*
This course covers the mechanical behavior and durability of structural materials. Properties of steel, concrete, wood, asphalt and fiber composites are discussed. Material processing, optical metrology and stress analysis laboratories are conducted by students working independently and in groups on material preparation and evaluation topics. | Prerequisite: CE-UY 2133 or CE-UY 2122 or equivalents. | Weekly Lecture Hours: 2 | Weekly Lab Hours: 3
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** CE-UY 2133 or CE-UY 2122 or equivalents.

**CE-UY 3183 Structural Engineering (3 Credits)**
*Typically offered Fall and Spring*
This course introduces the general principles of loads on buildings. It includes: steel design of tension member, beams, columns and beam column, and concrete design of beams, columns and footings. | Prerequisite: CE-UY 2122 and CE-UY 2143, or equivalents.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** CE-UY 2122 and CE-UY 2143, or equivalents.

**CE-UY 3223 Fundamentals of Environmental Engineering (3 Credits)**
*Typically offered Fall and Spring*
This course will introduce students to a range of areas within environmental engineering, and provide tools for analysis of environmental engineering problems. Topics include materials balance, ideal reactor models, environmental chemistry, public health risk assessment, air quality, water quality, drinking water treatment, wastewater treatment, and laboratory analysis of water and wastewater samples and treatment processes. | Prerequisites: (CM-UY 1003 and CM-UY 1001) or (CM-UY 1013 and CM-UY 1011) or CHEM-UA 125, or equivalent; Co-requisite: CE-UY 2213. | Weekly Lecture Hours: 2.5 | Weekly Lab Hours: 1.5
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** (CM-UY 1003 and CM-UY 1001) or (CM-UY 1013 and CM-UY 1011) or CHEM-UA 125, or equivalent; Co-requisite: CE-UY 2213.

**CE-UY 3233 Environmental Engineering Process Design (3 Credits)**
*Typically offered Spring*
This course introduces students to major processes used for the treatment of water, soil, and air. An introduction to the theory behind commonly used physical, chemical and biological treatment processes will be covered, along with practical information regarding their implementation for mitigation of environmental contaminants. Students will learn basic design equations and criteria for unit treatment processes, as well as concepts required for overall process design. | Prerequisites: CE-UY 3223 or equivalent.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** CE-UY 3223 or equivalent.

**CE-UY 3243 Water Resources Engineering (3 Credits)**
*Typically offered Fall and Spring*
This course provides a detailed overview of water resources engineering, including both analysis and design elements. Topics covered: open-channel flow; pipe networks; reservoir balances; hydrologic techniques; surface water and ground-water supplies; water demand; and development of water resources for multiple purposes. | Prerequisites: CE-UY 2213 or equivalent.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** CE-UY 2213 or equivalent.

**CE-UY 3263 Air Pollution Generation and Control (3 Credits)**
*Typically offered Fall*
This course introduces students to the study of air pollution, including measurements, causes and effects on the environment. Topics covered include: gas-phase and particulate pollution from various sources; energy and meteorological characteristics of the atmosphere in relation to the distribution of pollutants; evaluation and design of low emission systems and components; and practical solutions and governmental regulations for the present and future. | Prerequisite: CE-UY 3223 or equivalent
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** CE-UY 3223 or equivalent.

**CE-UY 3273 Environmental Data Analysis (3 Credits)**
*Typically offered Spring*
This course provides an overview of standard and innovative methods for analysis and modeling of environmental data. Topics include various methods for statistical analysis, interpretation, and contextualization of environmental data sets over space and time, with emphasis on characterizing and evaluating uncertainty. This course includes hands-on data collection in the field or laboratory, as well as sourcing historical data from online repositories. | Prerequisite: CE-UY 3223 and MA-UY 2224, or equivalents.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** CE-UY 3223 and MA-UY 2224, or equivalents.

**CE-UY 3303 Traffic Engineering (3 Credits)**
*Typically offered Spring*
This course covers the fundamentals of traffic engineering. The characteristics of traffic streams, and how they are quantitatively described are covered. Various types of traffic studies are covered including travel time, speed, delay, and safety studies. Determining the signal timing, capacity and level of service (LOS) of a signalized intersection is discussed and the Highway Capacity Software (HCS) is used to calculate intersection capacity and LOS. | Prerequisite: One CE-UY 23x3 course.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** One CE-UY 23x3 course.

**CE-UY 3363 Transportation Economics (3 Credits)**
*Typically offered occasionally*
This course introduces the principles of engineering economic analysis and applies them to the analysis of transportation alternatives. Alternative analyses are done using present worth analysis, annual cost analysis, benefit/cost analysis and rate of return analysis. The course also reviews existing measures and legislation that provide funding for transportation projects, and discusses potential new approaches for the future. | Prerequisite: One CE-UY 23x3 course.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** One CE-UY 23x3 course.

**CE-UY 3373 Transportation Systems Analytics (3 Credits)**
*Typically offered occasionally*
This course teaches students introductory methods to design transportation systems and informatics to evaluate the behavioral response of travelers. It trains students in fundamental problem solving skills needed to manage cyber-physical transportation networks in a smart cities era. The course is divided into three parts: (1) framework for analyzing urban systems under congestion and queueing, (2) intelligent transportation systems (ITS) to connect traveler decisions to system operations, and (3) constrained optimization methods to design and manage complex urban systems. | Prerequisite: (MA-UY 2224 or equivalent) and one CE-UY 23X3 course.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No

**CE-UY 3503 Cost Estimating (3 Credits)**
*Typically offered occasionally*
Students learn the classification of work, quantity surveying techniques and basic estimating principles applied to construction projects. Also addressed are contracts; specifications and other construction documents; and the identification and allocation of direct and indirect project costs, overhead and profit. Students are introduced to computer-based estimating techniques and software. | Prerequisite: Two CE-UY 25xx courses.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** Two CE-UY 25XX courses.

**CE-UY 3513 Construction Scheduling (3 Credits)**
*Typically offered occasionally*
Students learn to apply the Critical Path Method (CPM) to construction projects, using precedence diagram networks. The course covers sequencing, cost allocation, updating, cash flow, resource constraints and scheduling, manpower leveling and distribution, time-scale networks, lead and lag-time constraints, time-cost tradeoffs, overlap and other specific leading edge scheduling techniques. Students direct an entire project from planning through scheduling and control, both manually and through software. | Prerequisite: Two CE-UY 25xx courses.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** Two CE-UY 25XX courses.

**CE-UY 3533 Construction Site Layout and Surveying (3 Credits)**
*Typically offered occasionally*
This course studies the practical applications of surveying and its relationship to site planning and design. The first portion of the course concentrates on land surveying concepts, including mathematics, horizontal and vertical control, and angle measurement. The second portion of the course applies surveying data to site layout using traverses, area computations, property surveys, topography, and construction layout for highway and building applications. This course also includes a field laboratory which introduces students to basic surveying practice, including the use of surveying equipment (wheels, tapes, levels, and theodolites), measurements theory and computation, data accuracy and precision, and the use of the field book to properly record data. | Prerequisites: Two CE-UY 25xx courses.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** Two CE-UY25XX courses.

**CE-UY 3543 Building Information Modeling (3 Credits)**
*Typically offered occasionally*
This course covers the application of building information modeling (BIM) and related technologies in design and construction. Students will learn how to prepare a building information model workflow and use it for planning, estimating, scheduling and coordinating construction projects. Students will also experience how to utilize laser scanning and virtual reality tools and data. | Prerequisites: Two CE-UY 25xx courses.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** Two CE-UY 25XX courses.

**CE-UY 3553 Non-Structural Building Systems (3 Credits)**
*Typically offered occasionally*
This course introduces the students to mechanical, electrical and vertical transportation systems for buildings. It examines fundamental aspects of the design, procurement and construction of heating, ventilating and air conditioning (HVAC), supply and sanitary plumbing, fire detection and suppression, high- and low-voltage electrical, security, elevator and escalator and building management systems. | Prerequisite: Two CE-UY 25xx courses.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** Two CE-UY 25XX courses.

**CE-UY 4033 Introduction to Urban Infrastructure Systems Management (3 Credits)**
*Typically offered occasionally*
This course provides students with an overview of key issues involved in the planning, management, operations and maintenance of urban infrastructure systems, including transportation, water supply, power, communications and information systems. It includes elements of engineering and technology, management, economics, finance, regulatory and public policy that have an impact on the sustainable development of the urban environment. The course features several distinguished guest lecturers from infrastructure industries and public agencies who share significant case studies with students. The course includes a component on GIS, with a focus on how to collect, integrate and share spatial data in urban infrastructure management. Group projects are required. | Prerequisite: CE-UY 1002 or permission of the Civil Engineering Program Advisor.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** CE-UY 1002 or permission of the Civil Engineering Program Advisor.

**CE-UY 4043 Sustainable Cities (3 Credits)**
*Typically offered occasionally*
Considering the city as a building block for a more sustainable future, this course discusses sustainability metrics used, as well as the methods and tools for quantifying and achieving them. Particular attention will be given to climate action goals as one of the earliest manifestations of the push for sustainability. Using globally established aspirational goals for sustainability, and those set by local agencies, students gain an understanding of needs assessment, planning and technical approaches for the acquisition and analysis of data relevant to the study of urban sustainability. Areas of study include energy and renewables, waste, land use, urban climate and ecology, patterns of activity, and community engagement. This course provides a perspective on the role of information for better understanding of the function and wellbeing of urban systems. | Prerequisite: (CS-UY 1113 and MA-UY 2224) or permission of the Civil Engineering Program Advisor.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** (CS-UY 1113 and MA-UY 2224) or permission of the Civil Engineering Program Advisor.

**CE-UY 4092 Leadership, Business Principles, Policy and Ethics in Civil Engineering (2 Credits)**
*Typically offered Fall and Spring*
This course focuses on the professional practice of civil engineering and the role of the civil engineer in the planning, design, and construction processes. Topics include: professional roles and responsibilities; licensing, registration, and continuing education; engineering ethics; leadership, public policy and business principles; and engineering economics. The course also includes a zero-credit recitation that prepares students for the Fundamentals of Engineering (FE) examination, for which civil engineering students must register prior to graduation. | Prerequisite: CE-UY 3223, CE-UY 3243, (CE-UY 3183 or CE-UY 3233) and Senior standing; or permission of the Civil Engineering Program Adviser.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** CE-UY 3223, CE-UY 3243, (CE-UY 3183 or CE-UY 3233) and Senior standing; or permission of the Civil Engineering Program Adviser.

**CE-UY 4183 Reinforced Concrete Design (3 Credits)**
*Typically offered Spring*
This course offers a detailed treatment of reinforced concrete design: material properties, American Concrete Institute (ACI) load factors and design strength; shear and diagonal tension in beams; reinforced concrete columns; two-way slabs; footings; shear walls; and torsion. This course includes a group design project. | Prerequisite: CE-UY 3183 or equivalent.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** CE-UY 3183 or equivalent.

**CE-UY 4193 Timber and Masonry Structures (3 Credits)**
*Typically offered occasionally*
The course covers: Properties and classification of structural lumber; design of timber connectors; design and construction of residential and industrial timber buildings; beams, frames, columns and trusses of sawn lumber and glued laminated construction; manufacture and properties of concrete masonry units; properties of mortar and grout; and design and construction of load-bearing, reinforced and unreinforced masonry structural elements. The course includes a group design project. | Prerequisite: CE-UY 2143 or equivalent.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** CE-UY 2143 or equivalent.

**CE-UY 4213 Green Infrastructure Design (3 Credits)**
*Typically offered occasionally*
This course covers basic engineering design concepts for various types of green infrastructure used to control storm runoff and provide coastal protection in urban environments. Topics include: hydrologic analysis and modeling, hydraulic analysis, physical and biological treatment for water quality improvement, stormwater best management practices, TMDLs, ecological considerations, and sustainability of engineered solutions. | Prerequisites: CE-UY 3223 and CE-UY 3243, or equivalents.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** CE-UY 3223 and CE-UY 3243, or equivalents.

**CE-UY 4393 Analytics and Learning Methods for Smart Cities (3 Credits)**
*Typically offered occasionally*
Basics of analytics and learning methods, with extensive applications in smart cities. Focuses on introduction of analytics and learning algorithms in their very basic forms, implementation in common coding languages, and smart city applications. Topics include probability review, inference, linear regression, classification, neural networks, and introduction to reinforcement learning. Applications include autonomous vehicles, traffic control, public transit, ridesharing, urban emergency response, smart grid, and smart buildings. | Prerequisites: CS-UY 1113 and MA-UY 2224, or equivalents.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** CS-UY 1113 and MA-UY 2224, or equivalents.

**CE-UY 4503 Construction Engineering (3 Credits)**
*Typically offered occasionally*
This course covers engineering fundamentals and developing trends in the use of excavating and earth-moving equipment, trucks, pumps, drilling and blasting equipment and cranes. Also considered are shoring and bracing and other temporary site construction operations. | Prerequisite: Two CE-UY 25xx courses.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** Two CE-UY 25XX courses.

**CE-UY 4513 Construction Project Administration (3 Credits)**
*Typically offered occasionally*
This course examines the roles of the project participants in executing a construction project, focusing on delegating administrative duties and responsibilities and managing and coordinating the physical work and administrative control of project information and records. Students use computer-based project administration techniques and software. | Prerequisites: Two CE-UY 25xx courses.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** Two CE-UY 25XX courses.

**CE-UY 4523 Structural Building Systems (3 Credits)**
*Typically offered occasionally*
This course introduces the general principles of loads on buildings and the design and analysis of conventional structural building systems in steel, concrete, wood and masonry. It also addresses the construction of such systems. | Prerequisite: Two CE-UY 25xx courses.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** Two CE-UY 25XX courses.

**CE-UY 4533 Construction Law (3 Credits)**
*Typically offered occasionally*
The course introduces students to areas of the law that they are likely to encounter in construction. Following an introduction to the legal system and form of legal analysis, areas addressed include contracts, procurement, scope definition, delays and acceleration, site conditions, warranties, termination, tort claims, dispute resolution and ethics. | Prerequisite: Two CE-UY 25xx courses.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** Two CE-UY 25XX courses.

**CE-UY 4623 Selected Topics in Environmental and Water Resources Engineering (3 Credits)**
*Typically offered occasionally*
This course examines unique topics of current interest in environmental and water resources engineering. The course may feature a detailed look at a single topic or a series of focused topical presentations. | Prerequisite: Permission of the Civil Engineering Program Adviser.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** Yes

**CE-UY 4643 Selected Topics in Construction Management (3 Credits)**
*Typically offered occasionally*
This course covers unique topics of current interest in construction management. The course may feature a detailed look at a single topic or a series of focused topical presentations. | Prerequisite: Permission of the Civil Engineering Program Adviser.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** Yes

**CE-UY 4710 Readings in Civil Engr I (0.5-4 Credits)**
*Typically offered Fall, Spring, and Summer terms*
These readings in subjects related to the civil engineering curriculum are individually guided. Topics arise from a regular course and must extend and transcend material covered in the traditional curriculum. Students need prior approval of the instructor with whom he or she is to work and a topic approved by that instructor before registering for a readings course. Such courses require a written report on the subject of the student's readings before a grade is given. A student may take this course more than once.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** Yes

**CE-UY 4803 Civil Engineering Capstone (3 Credits)**
*Typically offered Fall and Spring*
This capstone course focuses on civil engineering site planning and design including grading and earthwork, stormwater management, site structures, traffic access and parking, water supply and sewage disposal, erosion control, and construction scheduling and estimating. Students work in groups. Formal progress reports, a final design report, full design drawings, and oral presentation are required. | Prerequisite(s): (CE-UY 2343 or CE-UY 3303 (or equivalent)), CE-UY 2533, CE-UY 3153, CE-UY 3183, CE-UY 3243, and Senior standing.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** (CE-UY 2343 or CE-UY 3303 (or equivalent)), CE-UY 2533, CE-UY 3153, CE-UY 3183, CE-UY 3243, and Senior standing.

**CE-UY 4813 Structural Engineering Capstone (3 Credits)**
*Typically offered Spring*
This course is the senior capstone experience in structural engineering that requires students to demonstrate the skills acquired through their undergraduate civil engineering curriculum. Students work individually or in groups as determined by the instructor and other participating industry advisers. Students are responsible for periodic submissions, as well as interim and final reports, including a final presentation. | Prerequisites: (CE-UY 4183 or equivalent) or (CE-UY 3143 or equivalent) and Senior standing.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** (CE-UY 4183 or equivalent) or (CE-UY 3143 or equivalent) and Senior standing.

**CE-UY 4833 Transportation Engineering Capstone (3 Credits)**
*Typically offered Fall*
This course is the senior capstone experience in transportation engineering that requires students to demonstrate the skills acquired through the undergraduate curriculum. Students work individually or in groups as determined by the instructor and other participating industry advisers. Students are responsible for periodic submissions as well as interim and final reports, including a final presentation. | Prerequisites: (CE-UY 3303 or CE-UY 3373) and Senior standing.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** (CE-UY 3303 or CE-UY 3373) and Senior standing.

**CE-UY 4853 Construction Management Capstone (3 Credits)**
*Typically offered Spring*
This course is the senior capstone experience in construction management which requires students to demonstrate the skills acquired through the undergraduate construction management curriculum. Students work individually or in groups as determined by the instructor and other participating industry advisers. Students are responsible for periodic submissions, as well as interim and final reports, including a final presentation. | Prerequisites: CE-UY 2533, one additional CE-UY 25xx course, and one additional CE-UY 25xx, 35xx or 45xx course and Senior standing.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** CE-UY 2533, one additional CE-UY 25xx course, and one additional CE-UY 25xx, 35xx or 45xx course and Senior standing.

**CE-UY 4863 Environmental Engineering Capstone (3 Credits)**
*Typically offered Fall*
This course is the senior capstone experience in environmental engineering that requires students to demonstrate the skills acquired through their undergraduate civil engineering curriculum. Students work individually or in groups as determined by the instructor and other participating industry advisers. Students are responsible for periodic submissions, as well as interim and final reports, including a final presentation. | Prerequisites: CE-UY 3233, CE-UY 3243 and Senior standing.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** CE-UY 3233, CE-UY 3243 and Senior standing.

**CE-UY 4911 Civil Engineering Internship I: Management (1 Credit)**
*Typically offered Fall, Spring, and Summer terms*
This course provides undergraduate students with a foundation for success. The course supports the development of professional and interpersonal skills gained through participation in an internship. The course combines (1) required reading, (2) an online educational module, and (3) an immersive internship in a relevant practice area. | Prerequisite: Cumulative GPA >2.5, Sophomore or higher standing and permission of CUE department
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** Cumulative GPA >2.

**CE-UY 4921 Civil Engineering Internship II: Ethics (1 Credit)**
*Typically offered Fall, Spring, and Summer terms*
This course provides undergraduate students with a foundation for success. The course supports the development of professional and interpersonal skills gained through participation in an internship. The course combines (1) required reading, (2) an online educational module, and (3) an immersive internship in a relevant practice area. | Prerequisite: Cumulative GPA >2.5, Sophomore or higher standing and permission of CUE department.
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** Cumulative GPA >2.5, Sophomore or higher standing and permission of CUE department.

**CE-UY 4931 Civil Engineering Internship III: Leadership (1 Credit)**
*Typically offered Fall, Spring, and Summer terms*
This course provides undergraduate students with a foundation for success. The course supports the development of professional and interpersonal skills gained through participation in an internship. The course combines (1) required reading, (2) an online educational module, and (3) an immersive internship in a relevant practice area. | Prerequisite: Cumulative GPA >2.5, Sophomore or higher standing and permission of CUE department
**Grading:** Ugrd Tandon Graded
**Repeatable for additional credit:** No
**Prerequisites:** Cumulative GPA >2.

**CE-UY 4990 Fundamentals of Engineering Exam Registration for CUE (0 Credits)**
*Typically offered Fall, Spring, and Summer terms*
This is a non-credited course that verifies registration by CUE students in required Fundamentals of Engineering (FE) exam. | Prerequisites: Senior standing or permission of the Civil Engineering Program Adviser.
**Grading:** Ugrd Tandon Pass/Fail
**Repeatable for additional credit:** No
**Prerequisites:** Senior standing or permission of the Civil Engineering Program Advisor.