

CIVIL & URBAN ENGINEERING (CE-UY)

CE-UY 496X UNDERGRADUATE RESEARCH PROJECT IN CIVIL AND URBAN ENGINEERING (1-3 Credits)

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 standing, cumulative GPA > 2.7, and permission of the Civil Engineering Program Advisor.

Grading: Satisfactory/Unsatisfactory

Repeatable for additional credit: Yes

Prerequisites: Junior standing, cumulative GPA > 2.7, and permission of the Civil Engineering Program Advisor.

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 standing, cumulative GPA > 3.0, and permission of the Civil Engineering Program Advisor

Grading: Satisfactory/Unsatisfactory

Repeatable for additional credit: Yes

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 a laboratory on 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 advisor.

Grading: Ugrd Tandon Graded

Repeatable for additional credit: No

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

CE-UY 2113 Statics (3 Credits)

Typically offered Fall and Spring

The course covers: Vector treatment of static and dynamic equilibrium of particles and rigid bodies; equivalent forces and couple systems; distributed forces; static analysis of determinate trusses, frames and machines; friction; centroid and center of gravity, and moment of inertia. | Prerequisite: PH-UY 1013 and MA-UY 1024 or MA-UY 1324 or equivalent (C or better).

Grading: Ugrd Tandon Graded

Repeatable for additional credit: No

Prerequisites: PH-UY 1013 and MA-UY 1024 or MA-UY 1324 or equivalent (C or better).

CE-UY 2114 Statics (3 Credits)

The course covers: Vector treatment of static and dynamic equilibrium of particles and rigid bodies; equivalent forces and couple systems; distributed forces; static analysis of determinate trusses, frames and machines; friction; centroid and center of gravity, and moment of inertia. | Prerequisite: PH-UY 1013 and MA-UY 1024 or MA-UY 1324 or equivalent (C or better).

Grading: Ugrd Tandon Graded

Repeatable for additional credit: No

Prerequisites: PH-UY 1004 with a Minimum Grade of D).

Corequisites: (PH-UY 1004 OR.

CE-UY 2123 MECHANICS OF MATERIALS (3 Credits)

Typically offered Fall and Spring

This course introduces basic principles of stress and strain in axial loading, shear, torsion and bending, along with principles of transformation of stress for design. Laboratory experiments provide hands-on experience. | Prerequisite: PH-UY 1013 and CE-UY 2113 (C or better) or equivalents.

Grading: Ugrd Tandon Graded

Repeatable for additional credit: No

CE-UY 2124 MECHANICS OF MATERIALS (3 Credits)

This course introduces basic principles of stress and strain in axial loading, shear, torsion and bending, along with principles of transformation of stress for design. Laboratory experiments provide hands-on experience. | Prerequisite: PH-UY 1013 and CE-UY 2113 (C or better) or equivalents.

Grading: Ugrd Tandon Graded

Repeatable for additional credit: No

Prerequisites: CE-UY 2113 with a Minimum Grade of D.

CE-UY 2131 Statics for Environmental Engineers (1 Credit)

Typically offered Fall and Spring

This course covers vector analysis of the static equilibrium of particles and rigid bodies including equivalent forces and couple systems, distributed forces, and free body diagrams; and centroid and moment of inertia calculations. | Prerequisites: PH-UY 1013 or equivalent (grade of C or higher) and MA-UY 1024 and MA-UY 1324 or equivalent (grade of C or higher).

Grading: Ugrd Tandon Graded

Repeatable for additional credit: No

CE-UY 2133 ENGINEERING MECHANICS (3 Credits)*Typically offered Fall and Spring*

This course covers the calculation of forces and moments, displacement and rotations, stresses and strains for simple structure subject to axial, shear, bending and torsional forces including basic principles of strain and stress for application design. | Prerequisite: PH-UY 1013 (grade of C or higher) and MA-UY 1024 or MA-UY 1324 or equivalent (grade of C or higher).

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**Prerequisites:** PH-UY 1013 (grade of C or higher) and MA-UY 1024 or MA-UY 1324 or equivalent (grade of C or higher).**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 or equivalent with a grade of C or better.

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.**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

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**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 permission of Civil Engineering Program Advisor

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**Prerequisites:** CE-UY 1002 or permission of Civil Engineering Program Advisor.**CE-UY 2504 Construction Modeling and Data Structures I (4 Credits)***Typically offered Fall*

This course introduces architectural drafting and computer graphics. It capitalizes on state-of-the-art computer applications in managing construction. The course familiarizes the student with two-dimensional construction drawings that represent the current industry standard, and it propels the student towards the future by teaching the basics of three-dimensional (3-D) computer modeling. This course also introduces the use of the 3-D model with associated databases to manage construction. | Prerequisite: CE-UY 1502 or CE-UY 1002 or permission of the Construction Management Program Advisor

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**Prerequisites:** CE-UY 1502 or CE-UY 1002 or permission of the Construction Management Program Advisor.**CE-UY 2513 CONSTRUCTION MATERIALS & 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 Standing

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**Prerequisites:** CE-UY 1002 or Sophomore or higher Standing.**CE-UY 2523 CONTRACTS & 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 Standing

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**Prerequisites:** CE-UY 1002 or Sophomore 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 Standing

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**Prerequisites:** CE-UY 1002 or Sophomore Standing.**CE-UY 3013 COMPUTING IN CIVIL ENGINEERING (3 Credits)***Typically offered 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 week. There will be multiple homework assignments and in-class quizzes for the evaluating the students' performances. | Prerequisite: (CS-UY 1113 or CS-UY 1114 or CS-UY 1133) and MA-UY 2034 and MA-UY 2224 or Adviser's approval.

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.**CE-UY 3122 STRUCTURAL DYNAMICS (2 Credits)***Typically offered Fall and Spring*

The course covers: Three-dimensional treatment of the kinetics of particles and rigid bodies using various coordinate systems; Newton's law, work, energy, impulse and momentum; and an introduction to dynamics of one, two and multi-degree of freedom systems, with and without damping. | Prerequisites: (MA-UY 2034 or MA-UY 2012) and (CE-UY 2113 or equivalents), Co-requisite: (CE-UY 2143 or equivalent) or (CE-UY 3133 or equivalent).

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**CE-UY 3123 DYNAMICS OF EXTREME EVENTS (3 Credits)***Typically offered Spring*

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)**

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 equivalent.

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**CE-UY 3134 Structural Analysis (3 Credits)***Typically offered Fall and Spring*

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 equivalent.

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**CE-UY 3143 STEEL DESIGN (3 Credits)***Typically offered occasionally*

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**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 equivalent.

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No

CE-UY 3154 Geotechnical Engineering (3 Credits)

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 equivalent.

Grading: Ugrd Tandon Graded

Repeatable for additional credit: No

CE-UY 3161 Materials Engineering Laboratory (1 Credit)

Typically offered Fall and Spring

This laboratory course consists of a series of experiments to test various engineering properties of common civil engineering materials including metals, aggregates, concrete, timber, and polymer composites. | Prerequisite: CE-UY 2123 or equivalent.

Grading: Ugrd Tandon Graded

Repeatable for additional credit: No

Prerequisites: CE-UY 2123 or equivalent.

CE-UY 3162 Materials Engineering (2 Credits)

Typically offered Fall and Spring

This course covers all commonly used civil engineering materials: metals, concrete, masonry, timber, asphalt, and polymer composites. It emphasizes fundamental materials science, production and processing, engineering properties, chemical durability, and practical applications. Materials sustainability and latest development in innovative materials and technology are also covered. | Prerequisite: CE-UY 2123 or equivalent.

Grading: Ugrd Tandon Graded

Repeatable for additional credit: No

Prerequisites: CE-UY 2123 or equivalent.

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 equivalent.

Grading: Ugrd Tandon Graded

Repeatable for additional credit: No

Prerequisites: CE-UY 2133 or equivalent.

CE-UY 3173 STRUCTURAL DESIGN (3 Credits)

Typically offered Fall, Spring, and Summer terms

This course covers steel and reinforced concrete structural design principles and practices, including: reinforced concrete beams, columns, slabs and footings, steel tension, compression and flexural members, beam-columns, and bolted connections. | Prerequisite for Brooklyn Engineering Students: CE-UY 2143 or CE-UY 3133 | Prerequisite for Abu Dhabi Students: ENGR-UH 3410

Grading: Ugrd Tandon Graded

Repeatable for additional credit: No

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 2143 or Equivalent.

Grading: Ugrd Tandon Graded

Repeatable for additional credit: No

Prerequisites: CE-UY 2143 or Equivalent.

CE-UY 3223 FUNDAMENTALS OF ENVIRONMENTAL ENGINEERING (3 Credits)

Typically offered occasionally

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; Co-requisite: CE-UY 2213.

Grading: Ugrd Tandon Graded

Repeatable for additional credit: No

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; Co-requisite: CE-UY 2253

Grading: Ugrd Tandon Graded

Repeatable for additional credit: No

Prerequisites: CE-UY 3223 or equivalent; Co-requisite: CE-UY 2253.

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

Grading: Ugrd Tandon Graded

Repeatable for additional credit: No

Prerequisites: CE-UY 3223.

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 3224

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**Prerequisites:** CE-UY 3223 and MA-UY 2224.**CE-UY 3303 Traffic Engineering (3 Credits)***Typically offered Fall and 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: 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 3313 Introduction to Transportation Systems (3 Credits)***Typically offered Spring*

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 and Junior status; or permission of the Civil Engineering Program Advisor.

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**Prerequisites:** CE-UY 1002 and Junior status; or permission of the Civil Engineering Program Advisor.**CE-UY 3323 FUNDAMENTALS OF ENVIRONMENTAL ENGINEERING (3 Credits)***Typically offered occasionally*

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; Co-requisite: CE-UY 2213.

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**CE-UY 3363 Transportation Economics (3 Credits)**

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: CE-UY 1002 and Sophomore standing; or permission of the Civil Engineering Program Advisor.

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**Prerequisites:** CE-UY 1002 and Sophomore standing; or permission of the Civil Engineering Program Advisor.**CE-UY 3373 TRANSPORTATION SYSTEMS ANALYTICS (3 Credits)***Typically offered Fall*

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) or permission of the Civil Engineering Program Advisor.

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**CE-UY 3503 Cost Estimating (3 Credits)***Typically offered Fall*

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 course must be completed before enrolling in any CE-UY 35xx or 45xx course; A second CE-UY 25xx course is a co-requisite for a second CE-UY 35xx or CE-UY 45xx course.

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**Prerequisites:** Two CE-UY within the 25XX level must be completed.**CE-UY 3504 Cost Estimating (3 Credits)**

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 course must be completed before enrolling in any CE-UY 35xx or 45xx course; A second CE-UY 25xx course is a co-requisite for a second CE-UY 35xx or CE-UY 45xx course.

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**Prerequisites:** (CE-UY 1504 with a Minimum Grade of D OR CE-UY 1002 with a Minimum Grade of D).

CE-UY 3513 Construction Scheduling (3 Credits)*Typically offered Fall*

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 course must be completed before enrolling in any CE-UY 35xx or 45xx course; A second CE-UY 25xx course is a co-requisite for a second CE-UY 35xx or CE-UY 45xx course.

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**CE-UY 3514 Construction Scheduling (3 Credits)**

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 course must be completed before enrolling in any CE-UY 35xx or 45xx course; A second CE-UY 25xx course is a co-requisite for a second CE-UY 35xx or CE-UY 45xx course.

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**Prerequisites:** CE-UY 2504 with a Minimum Grade of D.**CE-UY 3533 CONSTRUCTION SITE LAYOUT & SURVEYING (3 Credits)***Typically offered Fall*

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 course must be completed before enrolling in any CE-UY 35xx or 45xx course; A second CE-UY 25xx course is a co-requisite for a second CE-UY 35xx or CE-UY 45xx course

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**CE-UY 3543 BUILDING INFORMATION MODELING (3 Credits)***Typically offered Fall and Spring*

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 course must be completed before enrolling in any CE-UY 35xx or 45xx course; A second CE-UY 25xx course is a co-requisite for a second CE-UY 35xx or CE-UY 45xx course.

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**CE-UY 3553 Non-Structural Building Systems (3 Credits)***Typically offered Spring*

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 course must be completed before enrolling in any CE-UY 35xx or 45xx course; A second CE-UY 25xx course is a co-requisite for a second CE-UY 35xx or CE-UY 45xx course.

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**CE-UY 3563 CONSTRUCTION MODELING AND DATA STRUCTURES II (3 Credits)***Typically offered Spring*

This course is the continuation of the student's exploration of construction management through building information modeling (BIM). The student will apply their understanding of construction assemblies, trade scheduling and estimating through studies of a larger project. Emphasis will be placed on the student's ability to model complex assemblies while coordinating and scheduling multiple trades. This progressive approach incorporates the 3D model and the associated databases in the management of construction by developing unit pricing, detailed scheduling and procurement attributes associated with a design. | Prerequisite: CE-UY 2504

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**Prerequisites:** CE-UY 2504 with a Minimum Grade of D.

CE-UY 4033 Introduction to Urban Infrastructure Systems Management (3 Credits)

Typically offered Fall

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 Spring

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 and Senior Status; or permission of the Civil Engineering Program Advisor.

Grading: Ugrd Tandon Graded

Repeatable for additional credit: No

Prerequisites: CE-UY 3223, CE-UY 3243, CE-UY 3183 and Senior Status; or permission of the Civil Engineering Program Advisor.

CE-UY 4153 STRUCTURAL DESIGN PROJECT (3 Credits)

Typically offered Fall, Spring, and Summer terms

This course covers the modeling, analysis and design of a steel or concrete building structure. Fundamental concepts of structural analysis and design are reinforced and applied. Computer-aided structural analysis and design software is introduced and utilized as in professional practice. Students may work individually or in groups to prepare interim and final reports. | Prerequisite for Brooklyn Engineering Students: CE-UY 3173 or equivalent | Prerequisite for Abu Dhabi Students: ENGR-UH 3430 and ENGR-UH 3431.

Grading: Ugrd Tandon Graded

Repeatable for additional credit: No

Prerequisites: Prerequisite for Brooklyn Engineering Students: CE-UY 3173 or equivalent | Prerequisite for Abu Dhabi Students: ENGR-UH 3430 and ENGR-UH 3431.

CE-UY 4183 Reinforced Concrete Design (3 Credits)

Typically offered not typically offered

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

CE-UY 4193 Timber and Masonry Structures (3 Credits)

Typically offered Spring

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

Grading: Ugrd Tandon Graded

Repeatable for additional credit: No

Prerequisites: CE-UY 2143.

CE-UY 4213 GREEN INFRASTRUCTURE DESIGN (3 Credits)

Typically offered Fall

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

Grading: Ugrd Tandon Graded

Repeatable for additional credit: No

CE-UY 4232 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; Co-requisite: CE-UY 2213.

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**Prerequisites:** CE-UY 2213 with a Minimum Grade of D AND (CE-UY 3222 with a Minimum Grade of D OR CE-UY 4232 with a Minimum Grade of D).**CE-UY 4393 ANALYTICS AND LEARNING METHODS FOR SMART CITIES (3 Credits)***Typically offered Fall*

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 equivalent

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**CE-UY 4503 Construction Engineering (3 Credits)***Typically offered Spring*

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 course must be completed before enrolling in any CE-UY 35xx or 45xx course; A second CE-UY 25xx course is a co-requisite for a second CE-UY 35xx or CE-UY 45xx course

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**CE-UY 4513 Construction Project Administration (3 Credits)***Typically offered Fall*

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 course must be completed before enrolling in any CE-UY 35xx or 45xx course; A second CE-UY 25xx course is a co-requisite for a second CE-UY 35xx or CE-UY 45xx course

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**CE-UY 4523 Structural Building Systems (3 Credits)***Typically offered Fall*

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 course must be completed before enrolling in any CE-UY 35xx or 45xx course; A second CE-UY 25xx course is a co-requisite for a second CE-UY 35xx or CE-UY 45xx course

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**Prerequisites:** Two CE-UY class at the 25XX must be completed.**CE-UY 4533 Construction Law (3 Credits)***Typically offered Spring*

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 course must be completed before enrolling in any CE-UY 35xx or 45xx course; A second CE-UY 25xx course is a co-requisite for a second CE-UY 35xx or CE-UY 45xx course.

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**Prerequisites:** Two CE-UY class at the 25XX must be completed.**CE-UY 4543 CONSTRUCTION MANAGEMENT CAPSTONE (3 Credits)***Typically offered Fall and 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**Corequisites:** One CE-UY 25xx, 35xx or 45xx course AND Senior Standing.**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: adviser approval.

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** Yes**CE-UY 4643 Selected Topics in Construction Management (3 Credits)**

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: advisor approval.

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** Yes

CE-UY 4710 Readings in Civil Engineering (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**CE-UY 4813 Structural Engineering Capstone (3 Credits)***Typically offered Fall*

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 final report including a final presentations. | Prerequisites: (CE-UY 4183 or equivalent) OR (CE-UY 3143 or equivalent) AND Senior Standing.

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**CE-UY 4822 Civil Engineering Design II (2 Credits)***Typically offered Fall and Spring*

This is the second part of a two-semester capstone design project course for Civil Engineers. Each year a specific project will created. Student groups will be formed, and each group will develop its plan and design for the assigned project. Formal progress reports will be required, and a full design report will have to be prepared, submitted, and orally defended each semester. | Prerequisite(s): CE-UY 4153 or advisor's consent, Corequisite(s): CE-UY 4812 (with advisor's consent)

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**Prerequisites:** CE-UY 4153; Corequisite: CE-UY 4812 (with advisor's consent).**CE-UY 4833 Transportation Engineering Capstone (3 Credits)***Typically offered Spring*

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**CE-UY 4843 Urban Informatics Capstone (3 Credits)***Typically offered Spring*

This course is the senior capstone experience in urban and infrastructure informatics 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 4043

Grading: Ugrd Tandon Graded**Repeatable for additional credit:** No**CE-UY 4853 CONSTRUCTION MANAGEMENT CAPSTONE (3 Credits)***Typically offered Fall and 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**Corequisites:** One 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**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 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 standing and permission of CUE department.

Grading: Ugrd Tandon Graded

Repeatable for additional credit: No

Prerequisites: Cumulative GPA >2.5, sophomore 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 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 Advisor.

Grading: Ugrd Tandon Pass/Fail

Repeatable for additional credit: No