Course Name	Pts	Professor	Time
SUMA PS4130 Sustainable Cities	3	Jitendra Bajpai	Thursday, 4:10-6:00 pm. **ONLINE**
SUMA PS5162 Responsiveness and Resilience in the Built Environment	3	Lynnette Widder	Monday, 6:10-8:00 pm **IN PERSON**
SUMA PS5170 Sustainable Operations	3	Vance Merolla	Thursday, 6:10-8:00 p.m. **HYBRID – a combination of in-person and online classes**
SUMA PS5025 Corporate Sustainability Reporting & Strategy	3	Celine Ruben-Salama	Tuesday, 6:10-8:00 p.m. **ONLINE**
SUMA PS5205 Geographic Information Systems (GIS) for Sustainability Management	3	Dara Mendeloff	Wednesday, 6:10-8:00 p.m. **ONLINE**
SUMA PS5020 Cost Benefit Analysis **(Online)**	3	Satyajit Bose	Friday, 6:10-8:00 p.m. **ONLINE**
SUMA PS5195 Accounting, Finance, and Modeling of Sustainable Investments	3	Brad Schwartz	Wednesday, 6:10-8:00 p.m. **IN PERSON**
SUMA PS5650 Solar Project Development	3	Dan Giuffrida	Thursday, 6:10-8:00 pm. **ONLINE**
SUMA PS5146 Water Systems Analysis	3	Haralambos Vasiliadis	Tuesday, 6:10-8:00 p.m. **IN PERSON**
SUMA PS5230 Earth's Climate System	3	Ben Cook	Tuesday, 4:10-6:00 p.m. **IN PERSON**
SUMA PS5470 Circular Economy for Sustainability Professionals	3	Danielle Azoulay	Monday, 6:10-8:00 p.m. **IN PERSON**
SUMA PS5255 Data Analysis & Visualization in Sustainability	3	Carolynne Hultquist	Tuesday, 6:10pm-8:00 p.m. **IN PERSON**

Courses offered by the MS in Sustainability Management and Certification in Sustainability Analytics programs

SUMA PS4130 Sustainable Cities
Offered by MS in Sustainability Management Program
Call Number: 12250
Points: 3
Instructor: Jitendra Bajpai
Day/Time: Thursday, 4:10pm-6:00pm
Course Description: For the first time in history over half the world's population lives in urban areas. Today there are over 400 cities of more than million residents compared to 12 in 1900. By 2050 the share of the world urban population is expected to reach 70 percent, and most growth will occur in developing world. As urban population growth continues, urban centers face the problems of aging infrastructure, economic growth, changing climate, congestion, pollution, and demands of inhabitants to enhance their quality of life. Cities consume 75 percent of world's energy and produce almost 80 percent of global GHG emissions. In response many cities are striving to be low carbon city while sustaining healthy economic and social life. But addressing the new urban agenda requires a new model of cooperation across sectors and all tiers of government to redirect the urban economic development into paths that are restorative. The purpose of this course is to prepare its students to understand, analyze, and develop policies and procedures to address the sustainability issues being faced by urban centers of developed and developing world, their decision-makers and inhabitants.

SUMA PS5162 Responsiveness and Resilience in the Built Environment
Offered by MS in Sustainability Management Program
Area 3: Physical Dimensions
Call Number: 15546
Points: 3
Instructor: Lynnette Widder
Day/Time: Tuesday, 6:10pm-8:00pm
Course Description: What does our built environment tell us about sustainability? About our practices and values? How does it perform within the systems and cycles of the larger anthropogenic environment we inhabit? This course will consider analytical paradigms for understanding the inputs and throughputs of energy, material and labor as a method for quantifying resources. However, it will also offer methods to describe and account for the cultural significance that our environment represents within a forward-looking, critical context. You will be asked to attend weekly lectures and to prepare readings for discussion. In addition, one short group project and one term group project will challenge and train you to think integrally about the interplay of energy, material resources, labor and culture in an urban context – the Brooklyn Navy Yard redevelopment project. These group projects will be reviewed during in-class lab times and ultimately will be presented publicly to a group of guest critics. Lecture and workshop topics include systems paradigms, settlements and aggregations, thermal and electrical energy principles, built environment hydrology and visual communications strategies for sustainability management; case study presentations will bring these concepts to life. Readings include articles and books by Adrian Parr, William McDonough and Michael Braungart, Bill Bryson, Amy Seidl, Mike Davis and John McPhee, among others.

SUMA PS5170 Sustainable Operations

Offered by MS in Sustainability Management Program
Call Number: 12260
Points: 3
Instructor: Vance Merolla
Day/Time: Thursday, 6:10pm-8:00pm
Course Description: In this course, students will work to understand and communicate the importance of identifying and incorporating sustainability at each step along the value chain, including product design, procurement, distribution, manufacturing, product use and end-of-life disposition. By considering the organization holistically, students will perform analyses of the value chain, including Life Cycle and Cost/Benefit Analyses, and incorporate effective sustainability strategies into the organizational culture and day-to-day operations. Students will conduct risk analyses and implement risk reduction measures in an effort to develop, produce, and distribute more sustainable products and services, aligned with overall business goals. In addition to technical sustainability considerations such as climate change, energy, water and waste, students will be able to implement sustainability initiatives within operating organizations through innovative change management, culture change and other organizational strategies. Importantly, students will be challenged to think concretely about making choices and balancing elements of the triple bottom line in an overall business context.

SUMA PS5025 Corporate Sustainability Reporting and Strategy
Offered by the MS in Sustainability Management Program
Call Number: 12256
Points: 3
Instructor: Celine Ruben-Salama
Day/Time: Tuesday, 6:10pm-8:00pm
Course Description: The purpose of this course is to provide an overview of trends and best practices in corporate communications relating to sustainability, with a particular focus on global sustainability reporting frameworks and green marketing communications. It is designed for those who hold/will hold positions in organizations with responsibilities for communicating the sustainability goals, challenges and achievements, as well as accurately and honestly communicating the environmental aspects of an organization's products and services. Increasingly, large corporations are creating c-suite roles or dedicated departments to oversee this function. More typically, multiple functions contribute information such as: Corporate Communications, Marketing, Community Affairs, Public Policy, Environmental Health & Safety, R&D, Facilities, Operations and Legal. Benefits of reporting range from building trust with stakeholders, and uncovering risks and opportunities; to contributing to stronger long-term business strategy, and creating new products and services.

SUMA PS5205 Geographic Information Systems (GIS) for Sustainability Management
Offered by MS in Sustainability Management Program
Area 2: Quantitative Analysis/Area 3: Physical Dimensions
Call Number: 12268
Points: 3
Instructor: Dara Mendeloff
Day/Time: Wednesday, 6:10pm-8:00pm
Course Description: Geographic Information Systems (GIS) are a system of computer software, data and analysis methods used to create, store, manage, digital information that allow us to create maps and dynamic models to analyze the physical and social processes of the world. This course is designed to provide students with a comprehensive overview of theoretical concepts underlying GIS systems and to give students a strong set of practical skills to use GIS for stainable development research. Through a mixture of lectures, readings, focused discussions, and hands-on exercises, students will acquire an

understanding of the variety and structure of spatial data and databases, gain knowledge of the principles behind raster and vector based spatial analysis, and learn basic cartographic principles for producing maps that effectively communicate a message. Students will also learn to use newly emerging web based mapping tools such as Google Earth, Google Maps and similar tools to develop online interactive maps and graphics. The use of other geospatial technologies such as Remote Sensing and the Global Positioning System will also be explored in this class. Case studies examined in class will draw examples from a wide range of GIS applications developed to assist in the design, implementation and evaluation of sustainable development projects and programs.

SUMA PS5020 Cost-Benefit Analysis (Online)
Offered by MS in Sustainability Management Program
Call Number: 12557
Points: 3
Instructor: Satyajit Bose
Day/Time: Friday, 6:10pm-8:00pm
Course Description: This course is about cost-benefit analysis and the economic evaluations of policies and projects. Cost benefit analysis (CBA) consists of a comprehensive set of techniques used to evaluate government programs. It is now routinely applied in such program areas as transportation, water projects, health, training and education, criminal justice, environmental protection, urban policy and even in the international arena such as foreign direct investment. Many of the techniques of CBA can also be applied to private sector decision-making. The objective of CBA is to determine whether the benefits of a particular program, policy or decision outweigh its costs. The techniques used to determine this are sometimes quite simple, but on other, increasingly frequent occasions are highly sophisticated. Sophisticated cost benefit studies are based on a framework that utilizes the basic concepts of economic theory. In addition, statistical and econometric analyses are often needed to estimate program effects from diverse available data. The course has two parts: methodology and practice. The goal is for students to be practically adept to undertake an independent cost-benefit analysis.

SUMA PS5195 Accounting, Finance, and Modeling of Sustainable Investments*
Offered by MS in Sustainability Management Program
Call Number: 12261
Points: 3
Instructor: Brad Schwartz
Day/Time: Wednesday, 6:10pm-8:00 pm
***Note:** The course was formerly title “Green Accounting.” If you previously took the “Green Accounting” course, you are not eligible to take this course.
Course Description: This course examines traditional and emerging financial and cost accounting practices, non-financial sustainability performance metrics, their interdependencies and influence on corporate management, corporate reporting, and other systems. Students begin learning how financial performance is presented within traditional financial reports and analyzed using benchmarks, ratios and through interconnections with real world trends. They obtain critical insights and an appreciation of how financial and non-financial accounting data and sustainability performance metrics influence shareholder and corporate management investment decisions, strategic priorities, budget allocations and capital investments.

SUMA PS5650 Solar Project Development
Offered by the MS in Sustainability Management Program
Points: 3
Call Number: 12272

Instructor: Dan Giuffrida
Day/Time: Thursday, 6:10pm-8:00pm
Course Description: At the end of this course, students will be prepared to fully evaluate the technical and financial aspects of a solar project. They will be equipped with skills allowing them to either develop or rigorously vet solar project proposals. The course introduces and provides students with a holistic understanding of the end-to-end solar development process. The course has two goals: A) To provide students a deep understanding of the dozens of critical interrelated steps critical to developing a successful operating solar project. B) To equip the students with the tools and understanding of the skills necessary to develop a solar project beginning with site selection encompassing the entire process to commissioning and operations. We begin the course providing the students with an understanding of the different segments of the solar industry; covering the upstream business, the main players both upstream and downstream and then outlining the different downstream markets: utility, commercial, and residential. We will then hone in on the distributed generation segment of the market; commercial, and residential. To begin, we will cover the critical value drivers of solar: sunlight resource, grid energy cost, tax credits, state and utility incentives including renewable energy credit markets. Energy consumption and production, despite what critics will say about renewables, is the main value driver of the move to renewables. In that light, we will cover in detail, net metering, national and local electricity markets, and electric utility tariff structure to understand how value is generated and measured. We will conduct energy consumption analysis for different end-users to see how solar can and will be deployed and valued across different geographic and utility tariff classes.

SUMA PS5146 Water Systems Analysis
Offered by the MS in Sustainability Management Program
Area 3: Physical Dimensions
Call Number: 12258
Points: 3
Instructor: Haralambos Vasiliadis
Day/Time: Tuesday, 6:10pm-8:00pm
Course Description: This class provides a structured introduction to the integrated analysis of physical and institutional systems for water management and development. Multiple scales and settings, from developing country villages to a US city water supply to regional watershed restoration to national planning are considered. The emerging global water crisis driven by rapid population growth and its relation to agricultural water use will be a recurrent theme through the class. Novel topics include the consideration of climate variability and change in developing system operation rules and infrastructure planning. The course includes modules on integrated water management and water systems analysis including water supply/demand imbalances, the modeling and design of a regulatory system for water allocation and tools for conservation incentives and insurance system design; and a multi-scale view of operation and planning from weekly to seasonal to decadal planning for multiple, competing objective. There will be guest lectures from engineers/scientist/professors working in the water sector. This course provides students with an analytic framework for operating, managing, and planning water systems, considering values and needs.

SUMA PS5230 Earth's Climate System
Offered by the MS in Sustainability Management Program
Area 3: Physical Dimensions
Call Number: 12269
Points: 3
Instructor: Ben Cook
Day/Time: Tuesday, 4:10PM-6:00 PM

Course Description: This course examines the fundamental physical processes that control the primary features and patterns of variability of the Earth's climate system. Specific topics include energy balance and the greenhouse effect, the circulation of the oceans and atmosphere, land surface interactions and feedbacks, the role of the biosphere and cryosphere, paleoclimatoloy, climate modeling, and global and regional patterns of climate variability and change observed and expected as a consequence of anthropogenic influences. The goal of the course is to provide students with the opportunity to gain a fundamental understanding of the processes that give rise to observed climate variability at a range of temporal and spatial scales. Students will develop the quantitative skills and knowledge to allow them to independently evaluate scientific claims about the state and behavior of Earth's climate system in the past, present and future. The course includes case study modules that integrate an understanding of the physical processes and important feedbacks in the context of policy- and management-relevant aspects of current and future climate change.

SUMA PS5470 Circular Economy for Sustainability Professionals
Offered by MS in Sustainability Management Program
Call Number: 12271
Points: 3
Instructor: Danielle Azoulay
Day/Time: Monday, 6:10-8:00 PM
Course Description: A circular economy is an alternative economic model, that is restorative by design, and rather than relying on a constant throughput of newly extracted resources and non-renewable energy, aims to keep materials, products and components constantly at their highest utility and value. This course will delve into both the theory and practical applications of a circular economy. Achieving perfect circularity represents potentially transformative system change and will involve a fundamental re-think of many of our structures, systems and processes in the economy at large. At the same time, its value creation potential for businesses, households and the environment alike, is potentially extremely significant. For example, manufacturers can reclaim substantial value from the products they develop by introducing take-back schemes to reclaim components and resources for re-use or recycling, as opposed to allowing them to go to waste as would typically be the case in a linear system. We will explore the theoretical underpinnings of a circular economy, including the need for systems thinking (taking relevant learnings from biomimicry and industrial ecology). We will look to circular design principles and explore their use in different industries. We will pose the question of which stakeholders can help to facilitate this transition to circularity, and what enablers, in the form of policy and financing, will need to be in place to allow it to progress. The course will explore real-life examples of circular economic thinking in specific industries, such as the fashion and industry, as well as looking at its application in a geographic context through the lens of cities, and examining standalone infrastructure, such as waste management.

SUMA PS5255 Data Analysis & Visualization in Sustainability
Offered by MS in Sustainability Management Program
Call Number: 12270
Points: 3
Instructor: Carolynne Hultquist
Day/Time: Tuesday, 6:10-8:00 PM
Course Description: Data science is an exciting new field of applied research that takes advantage of the ever-growing volume of data being collected to support of decision-making in both the public and private sectors. Similar to traditional statistical analysis, these new approaches have limits and issues that are important to understand before application to problem solving. This course aims to introduce the common methods used in data science, best practices in data management, and the basic scripting skills required to start analyzing data in R and Python. After introducing foundational scripting and data

analysis methods, a case study approach will be used to highlight both what can be accomplished with data analysis and the limits of the data and methods used. Lab exercises will teach basic skills in scripting in Python and R and then move to a common approach for data analysis: adapting existing scripts and software libraries to solve applied data problems. The requirement to understand the interaction of social and natural systems requires data-driven policy decisions, and the ongoing assessment of policies requires rigorous, reproducible assessments of effectiveness for promoting sustainability. Both requirements can be met in part by data science approaches that are applicable to the natural and social sciences and reproducible in academic and applied settings. Data science techniques have been developed to derive insight from large volumes of available data that are often collected for purposes other than the interests of the data scientist. This flexibility in approach means that the techniques used in data science are well adapted to support gaining insights from data relevant for sustainability science. This course has been designed to introduce these techniques in anticipation of increased use in promoting sustainability. The course has no perquisites; however, an understanding of statistics and probability will be very useful background, and any previous programming or scripting skills will be applicable to the lab assignments.

Courses approved from other University Schools and Departments

EAEE E4001 Industrial Ecology of Earth Resources
Offered through Earth and Environmental Engineering, The Fu Foundation School of Engineering and Applied Science
Points: 3
Call Number: 13593
Instructor: Athanasios Bourtsalas
Day/Time: Tuesday, 4:10pm-6:40pm
Course Description: Industrial ecology examines how to reconfigure industrial activities so as to minimize the adverse environmental and material resource effects on the planet. Engineering applications of methodology of industrial ecology in the analysis of current processes and products and the selection or design of environmentally superior alternatives. Home assignments of illustrative quantitative problems.

EESC GU4008 Introduction to Atmospheric Science
Offered through Earth and Environmental Sciences, Graduate School of Arts and Sciences
Call Number: 12447
Points: 3
Instructor: Lorenzo M Polvani
Day/Time: Thursdays, 4:10pm-6:40pm
Course Description: Prerequisites: advanced calculus and general physics, or the instructor's permission. Basic physical processes controlling atmospheric structure: thermodynamics; radiation physics and radiative transfer; principles of atmospheric dynamics; cloud processes; applications to Earths atmospheric general circulation, climatic variations, and the atmospheres of the other planets.

EESC GU4050 Global Assessment and Remote Sensing
Offered through Earth and Environmental Sciences, Graduate School of Arts and Sciences
Call Number: 12448
Points: 3

Instructor: Christopher Small
Day/Time: Thursday, 5:40pm-6:55pm; Lab Required: Friday, 9:00am-11:00am
Course Description: Priority given to graduate students in the natural sciences and engineering. Advanced level undergraduates may be admitted with the instructor's permission. Calculus I and Physics I & II are required for undergraduates who wish to take this course. General introduction to fundamentals of remote sensing; electromagnetic radiation, sensors, interpretation, quantitative image analysis and modeling. Example applications in the Earth and environmental sciences are explored through the analysis of remote sensing imagery in a state-or-the-art visualization laboratory.

EAEE E4350 Planning/Management-Urban Hydrologic System
Offered through Earth and Environmental Engineering, The Fu Foundation School of Engineering and Applied Science
Call Number: 13592
Points: 3
Instructor: Eric A Rosenberg
Day/Time: Tuesday, 4:10pm-6:40pm
Course Description: Prerequisites: ENME E3161 or the equivalent. Introduction to runoff and drainage systems in an urban setting, including hydrologic and hydraulic analyses, flow and water quality monitoring, common regulatory issues, and mathematical modeling. Applications to problems of climate variation, land use changes, infrastructure operation and receiving water quality, developed using statistical packages, public-domain models, and Geographical Information Systems (GIS). Team projects that can lead to publication quality analyses in relevant fields of interest. Emphasis on the unique technical, regulatory, fiscal, policy, and other interdisciplinary issues that pose a challenge to effective planning and management of urban hydrologic systems.

EAEE E4550 Catalysis of Emissions Control
Offered through Earth and Environmental Engineering, The Fu Foundation School of Engineering and Applied Science
Call Number: 12840
Points: 3
Instructor: Robert Farrauto
Day/Time: Mondays and Wednesdays 2:40pm-3:55pm
Course Description: Prerequisites: One year of general college chemistry. Fundamentals of heterogeneous catalysis including modern catalytic preparation techniques. Analysis and design of catalytic emissions control systems. Introduction to current industrial catalytic solutions for controlling gaseous emissions. Introduction to future catalytically enabled control technologies.