Fall 2019 Sustainability Courses

Graduate Level

- Sustainability Focused Courses

College of Engineering:

**Sustainable Management Industrial Pol Pre (CEE 7514)**
Preventive environmental management approaches versus end of pipe treatment; cleaner production development and implementation; cleaner production tools such as environmental impact assessment, life cycle analysis, environmental technology assessment, chemical assessment, environmental compliance audit, waste audit, energy audit, risk audit, and good house keeping. Sustainable development and environmental ethics as integral components of pollution prevention approach.

**Sustainable Pavement Systems (CEE 8208)**
Pavement preservation, accelerated construction techniques, intelligent compaction, recycled and waste products in asphalt/concrete mixtures, energy translation from pavements, and the use of innovative materials in highway construction. Prerequisites: CEE 8439 (with permission of instructor in the absence of this prerequisite).

**Smart Energy Systems (ECE 8815)**
The modern electric power infrastructure; manifestations of the smart-grid; two-way, smart revenue metering for system operating efficiencies, maximal utilization of renewable resources, improved power quality, and automated management of service disruptions; and evolving technologies offering security, reliability, and environmental sustainability of the electric infrastructure.

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**Sustainable Innovations & Entrepreneurship (EGEN 7116)**

How to develop sustainable products, service innovations and businesses. Topics include customer engagement, lean product development, elements of sustainable business models and development of a strong value proposition.

**Fundamentals of Sustainable Engineering (EGR 7110)**

Introduction to the current state of science & public policy directions; development of a comprehensive framework for evaluating the challenges and opportunities resulting from Global Climate Change and Sustainability; application of technical/economic tools for solving high-potential opportunities.

**Economic/ Social Equity Integrators (EGR 7112)**

Developing a careful balance among the environmental, economic and social equity issues of a proposed product, service or infrastructure project; focus on specific tools and case studies; creating a holistic solution.

**Sustainable Materials and Design (EGR 7113)**

Comprehensive, systems-focused basis for selecting materials in new uses or as more sustainable alternatives; more eco-efficient alternatives, including technologies to reduce material intensity, renewably sourced materials, recyclable materials and material solutions inspired by nature (biomimetic). Non-engineering majors will require permission by the instructor.

**Trans Tech for Sustainable Solutions (EGR 7117)**

Transformative technology will be examined to contrast and compare potential new solutions to sustainability issues. Appropriate technology as well as learnings from nature will then be applied to develop improved solutions in a project-based learning environment.

**Intro to Sustainable Engineering for International Development (EGR 7120)**

Introduction to engineering in a developing community context; frameworks for applying engineering and technology to achieve sustainable development goals; geo-political, historical, institutional, economic, cultural, and ethical perspectives. NOTE: Intro course for the

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Sustainable Development track and should be the first course taken for this 4 course track program.

**Advanced LCA & Intro to Product Design (EGR 8111)**

This course is designed as an in-depth exploration of LCA issues and applications. Students will complete a baseline LCA semester team project then use sustainable product design techniques to reduce overall impacts of the product or material.

Villanova School of Business:

**Sustainable Real Estate Development (MBA 8827)**

This course reflects on the principles and processes of development including land acquisition, legal, zoning, planning and approvals. An in-depth study of the sustainable development of offices, mixed use communities, residential and renovation projects. Emphasis is on understanding and evaluating through case studies the design, architecture, sustainability and financial analysis of real estate development.

**Non-Profit Consulting Practicum (MBA 8910)**

This course is designed to give MBA students the opportunity to develop their professional skill set with a client firm that is serving the common good within the greater Philadelphia community. The focus is on strategic market management using a systems perspective within our Catholic and Augustinian tradition of supporting advancement of human dignity.

**Global Practicum (MBA 8920)**

Global project in which student will incorporate all knowledge gained in the MBA program. Can be part of a global immersion (required for Fast Track) or done domestically.

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- **Sustainability Related Courses**

College of Arts & Sciences:

**Environmental Chemistry (CHM 7517)**

Apply key concepts in chemistry to global scales by examining chemical systems within Earth's lithosphere, hydrosphere and atmosphere. Examine and discuss natural processes as well as anthropogenic impacts like climate change and environmental contamination using central scientific literature.

**Urban Politics and Government (MPA 8550)**

The study of city and suburban governments in metropolitan areas; special emphasis devoted to such topics as governmental form, city-suburb relations, race and ethnic relations, and economic change.

College of Engineering:

**Water Resource Planning and Management (CEE 7211)**

Theoretical and practical approaches to water resource planning, analysis, design, economics and management: ground water and surface water supply, wetlands protection, water quality, water demand projections and reservoir operation. Prerequisite: CEE 7111 or its undergraduate equivalent.

**Aquatic Chem Environmental Engineering (CEE 7701)**

Chemical kinetics; equilibrium analyses of water solutions incorporating solubility, ionization, acid-base, redox, and complexation considerations; use of graphical procedures to analyze complex mixtures; and, applications including pC-pH diagrams of the carbonate system, chemistry of iron and aluminum coagulants, alkalinity and acidity of natural waters, and metal complexation by organic ligands. Prerequisite: One year of undergraduate chemistry.

**Geosynthetics (CEE 8103)**

Design of civil engineering structures, such as retaining walls and landfills, using geosynthetics for reinforcement, drainage, filtration, separation, and containment. Prerequisite: Undergraduate Soil Mechanics

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CE Materials (CEE 8439)

Fundamentals of material science with applications to structural and transportation materials. Durability, fracture, fatigue, corrosion, non-destructive tests and properties of masonry, concrete, asphalt, and wood will be taught with discussion of laboratory testing, specifications, and quality assurance (QA) data analysis. Prerequisites: Undergraduate mechanics of materials course.

Surface Water Hydrology (CEE 8501)

Basic factors for hydraulic design and storage requirements; frequency and duration studies; runoff hydrographs; design storms and flood determinations; hydrologic and hydraulic routing; peak flow formulas; reservoir regulation; effects of land use and treatment; mathematical models including HEC-HMS. Prerequisite: CEE 7111 (or its equivalent).

Open Channel Hydraulics (CEE 8503)

Free surface flow in canals, chutes, bends, gradual and abrupt transitions, stilling basins and energy dissipators, constrictions, bridge waterways, spillways; channel delivery; water-surface profiles in artificial and natural channels; unsteady flow, wave propagation and surges; design criteria and case histories; mathematical models including HEC-RAS. Prerequisite: CEE 7111 (or its equivalent).

Zeolite (CHE 8531)

Properties and classes of nanomaterials, solid state physics semiconductors, characterization techniques, catalysis for energy transformations, fuel cells, batteries, solar cells, biofuels, hydrocarbons and hydrogen.

Thermodynamics (CHE 8575)

Advanced concepts of thermodynamics: equations of state, physical and chemical equilibrium, estimation of thermodynamic properties.

Biochemical Engineering I (CHE 8588)

Basics of biochemistry, microbiology, cell biology and molecular biology, as applied to bioproduct formation; enzyme kinetics, immobilized enzymes, diffusion limitations,

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immobilized enzyme reactors; cell growth kinetics, batch and continuous fermenter operation, bioreactor operation; sterilization, oxygen transfer and scaleup.

**Control Systems Engineering (EGR 8301)**

Review of dynamic process modeling, linearization, transfer function and state-space models. Stability and dynamics of open-loop and closed-loop systems. Feedback control system design and analysis in the frequency and time domain. Topics include: Bode, Nyquist, and Root locus design; multivariable control; feedforward control. Prerequisite: Undergraduate background in systems and control.

**Advanced Engrg Thermodynamics (ME 7103)**

An advanced treatment of engineering thermodynamics involving reversible and irreversible macroscopic processes with emphasis on fundamentals and applications of the first and second laws, and the thermodynamics of equilibrium states of substances. Seniors must have a minimum GPA of 3.0

Charles Widger School of Law:

**Journal: Environmental Law (LAW 6016)**

Journal: Environmental Law is a year-long course worth 1 to 4 credits based on position held in Journal. Students are selected to the Environmental Law Journal at the end of their first or second year through an open writing competition. Members of the Journal write scholarly articles on topics relating to Environmental Law, edit and prepare articles by outside authors for publication. The Journal publishes two issues each year and presents a symposium on a current topic.

**Environmental Law (LAW 7021)**

This course examines how the federal government regulates human activities that affect the natural environment. It focuses on four major federal environmental statutes: the Clean Air Act, the Clean Water Act, the Resource Conservation and Recovery Act (RCRA), and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as Superfund. The course exposes students to a variety of legal materials encountered in the practice of environmental law, including cases but also statutes, regulations, permits, guidance documents, and other administrative agency materials. Along the way, the course explores some recurring issues in environmental law, some of the different perspectives

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from which environmental issues are approached, and principles of constitutional and administrative law that are critical in environmental litigation.

**Villanova School of Business:**

**Soc. Enterp. Consulting Practices (MBA 8910)**

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**College of Nursing:**

**Nutrition and Global Health (NUR 7070)**

Examines existing and emerging issues in nutrition globally, with special emphasis on the developing world. Analyzes influence of human biology, the environment, culture, socioeconomic status, politics and international policies on nutrition and its impact on health of individuals and populations.

**International Health (NUR 7081)**

International and intercultural environments for nursing and health. Restricted to graduate students, or undergraduate students with permission.

**Principles of Nutrition (NTR 2120)**

Principles of normal nutrition and the interrelatedness of economics, culture and health.