Resilience at Northeastern

CLUBS/ORGANIZATIONS

RESEARCH

GRADUATE PROGRAMS

ALL COURSES

- African Studies
- Anthropology
- Architecture
- Bioengineering
- Biology
- Biotechnology
- Chemical Engineering
- Civil and Environmental Engineering
- Commerce and Economic Development
- Communication
- Computer Science
- Data Science
- Criminal Justice
- Earth and Environmental Studies
- Ecology, Evolution and Marine Biology
- Economics
- Energy Systems
- Entrepreneurship
- Geographic Information Systems (GIS)
- Global Studies
- Homeland Security
- Human Services
- International Affairs
- Marine Studies
- Physics
- Political Science
- Public Policy and Urban Affairs
- Sociology
- Telecommunications
CLUBS/ORGANIZATIONS

American Society of Civil Engineers
Northeastern Student Chapter of the American Society of Civil Engineers
http://neu.orgsync.com/org/nuasce/community_service

Northeastern University’s Growth and Resilience Improv Team
The mission of NU GRIT to dedicate ourselves to creating controlled-risk environment through improvisational theater games for participants to practice skills of resiliency and grit. We foster these skills by providing workshops in which both our members who host and the participants can nurture their resiliency.

We Are Your Story - Northeastern
a nonprofit organization which helps to facilitate development socially, economically and medically in impoverished communities domestically and internationally. In addition to volunteering in the Boston Area, the Northeastern Chapter of YourStory International will participate in trips to Leogane, Haiti. Alongside local employees, advocates (volunteers) perform specialized jobs in clinics and public health education. Advocates contribute to building sustainable solutions to help alleviate health disparities and empower the communities we serve. https://www.weareyourstory.org/

Engineering World Health of Northeastern University
Engineering World Health is dedicated to improving global health through biomedical engineering. Through EWH, students develop the skills and knowledge to tackle technical and design challenges in global health.

Engineers Without Borders
EWB is an entirely student-led organization working with communities in Honduras, Uganda and Panama to provide accessible drinking water.
http://www.ewb.neu.edu/

Global Medical Brigades/Global Public Health Brigade
The mission of Medical Brigades is to work with licensed medical professionals and community health workers to provide comprehensive health services in rural communities with limited access to healthcare. Our current partner is in Panama, where Medical Brigade volunteers have the opportunity to shadow licensed doctors in medical consultations and assist in a pharmacy under the direction of licensed pharmacists.
Northeastern University Institute of Transportation Engineers
NUITE’s primary mission is to enrich the depth and breadth of knowledge of the Transportation Engineering students at Northeastern University in the areas of transportation systems engineering and research through interaction with the larger engineering community. This includes organizing seminars, conferences, field trips, and other events that incorporate the different aspects of the Transportation Engineering field.
http://www.coe.neu.edu/orgs/nuite-institute-transportation-engineers-nu-student-chapter

Roxbury Robotics of Northeastern University
Roxbury Robotics is a community outreach program for students trying to connect with the community around the University. Typical engagement consists of a once a week visit to a local school, Boys and Girls Club, or community center to teach middle school aged children how to build a small Sumo or Lego Robot.
https://orgsync.com/165258/chapter

Husky Environmental Action Team
Husky Environmental Action Team (HEAT) is a student group working towards environmental sustainability and carbon neutrality at Northeastern University. HEAT raises awareness about sustainability issues at Northeastern University, works with the Administration of the University to establish and advance sustainability initiatives, and hosts events that promote responsible use of energy and waste. We target issues such as food, waste, energy, product life cycles, divestment from the fossil fuel industry, and recycling.
https://orgsync.com/27714/chapter

Department of Marine and Environmental Sciences Terra Society
The Terra Society organizes events that supplement our members’ education in the Earth & Environmental sciences. We provide students with a chance to work with professors in the Earth & Environmental Sciences department and network with students in similar disciplines.
https://orgsync.com/28186/chapter

IoT Connect of Northeastern University
IoT Connect is mainly focused on establishing a bond between students of Internet of Things (IoT) and the general IoT community which includes alumni, teaching faculty, industry, IoT organizations or any general IoT enthusiasts. It strives to inform about the latest developments in the field, and develop awareness of IoT among students of other disciplines.
https://orgsync.com/170586/chapter

Northeastern University Chapter of the New England Water Environment Association
NEWEA is an organization dedicated to connecting students and professionals involved in the water environment profession.
https://orgsync.com/67307/chapter

Political Science and International Affairs Student Association and Pi Sigma Alpha Chapter of Northeastern University
The mission of the PISA is to promote the nonpartisan study of, and interest in, politics and international affairs among Northeastern University students and other members of the Northeastern community. The PISA provides a forum for education, discussion, and social interaction around politics and political issues. PISA will advise the Department of Political Science at Northeastern University on curriculum and other relevant matters.
https://orgsync.com/27717/chapter
RESEARCH
Global Resilience Institute
https://globalresilience.northeastern.edu/
https://www.facebook.com/ResilienceNU/

Resilient Systems
Department of Mechanical and Industrial Engineering
http://www.mie.neu.edu/mie/research/resilient

George J Kostas Research Institute for Homeland Security
https://www.northeastern.edu/kostas/

GRADUATE PROGRAMS
Security and Resilience Studies
https://www.northeastern.edu/graduate/program/master-of-science-in-security-and-resilience-studies-14294/
Master of Science in Security and Resilience Studies
https://cssh.northeastern.edu/polisci/programs/ms-in-security-and-resilience-studies/
Certificate in Security and Resilience Studies
https://cssh.northeastern.edu/polisci/programs/certificate-in-srs/
21st Century Resilience Scholarship
https://cssh.northeastern.edu/polisci/financial-aid-awards/

COURSES*

African Studies
http://catalog.northeastern.edu/course-descriptions/afrs/
http://catalog.northeastern.edu/undergraduate/social-sciences-humanities/cultures-societies-global-studies/african-studies-minor/

AFRS 3424. Epidemiology of Pandemic Diseases and Health Disparities in the African Diaspora. 4 Hours.
Examines the epidemiology and determinants of diseases and the public health practice among continental African peoples and African-derived populations in the Americas and elsewhere in the African Diaspora. Emphasizes such epidemic diseases as malaria, yellow fever, tuberculosis, smallpox, the current AIDS pandemic, obesity, and cancer. The course also aims to critically address the breadth of factors behind these pandemics, such as socioeconomic, political, health system, behavioral, and genetic. A cross-cutting theme throughout the course is the entrenched health disparities in society.

AFRS 3464. Natural Resources and Sustainable Development. 4 Hours.
Examines the social dimensions of resource extraction. Focusing mainly on developing nations, studies global issues, including developments in industrial nations, to assess their impact on resource extraction and living and working conditions in resource-rich regions. Uses case studies of key countries producing oil/gas, minerals, and forest/agricultural commodities to illustrate the past/current causes of resource mismanagement; their social consequences; and how public policies, legislation, and financial and human resource management with industrialization can be used to avert or reduce the adverse effects of resource extraction, especially in poor countries.

AFRS 4939. Community Health, Culture, and Development in Kenya. 4 Hours.
Introduces the community health and development arena in Kenya. Community development has been presented as the panacea to many of Africa's problems, including leadership, democracy, conflict, disease, and poverty. Through teaching, research, and action, the course seeks to expose and sensitize students to the global and local debate on poverty, primary healthcare, and community development. Offers students an opportunity to gain hands-on experiences in some of the major determinants and solutions to poverty and disease by interacting with community stakeholders and organizations in a variety of cultural, rural, and urban settings and through visits to, and participating in, projects run by community-based organizations.

Anthropology

http://catalog.northeastern.edu/course-descriptions/anth/

https://cssh.northeastern.edu/socant/

ANTH 1101. Peoples and Cultures. 4 Hours.
Surveys basic concepts in cultural anthropology by looking at a range of societies and the issues they face in a globalizing world. Examines the manner in which cultures adapt to, reject, or modify all of the changes they face. These changes impact everything from traditional family structure, to religion, gender, all the way to patterns of joking and concepts of beauty the world over.

ANTH 3200. Cities in Global Context. 4 Hours.
Examines the roots of the urbanization process, major ways of thinking about it, and the development of world cities and megacities. The 21st century will be a century in which urbanism is a central problem and opportunity. Considers the economic, political, cultural, and environmental dimensions of urbanism across the globe. Includes specific case studies from around the world. Encourages students to develop a knowledge of particular cities in order to examine the key themes of the course. INTL 3200, ANTH 3200, and SOCL 3200 are cross-listed.

ANTH 3418. Wired/Unwired: Cybercultures and Technopolitics. 4 Hours.
Explores the impacts of technology and new media on politics, society, and culture. Emphasizes the socioeconomic and political frameworks within which technologies are embedded as well as the role of technology and the Internet in contemporary political and cultural movements. Topics may include the political and cultural effects of the census, the radio, and the camera; the history of the Internet; virtual worlds and communities; online politics and activism; as well as blogging, gaming, and social networking.

Architecture

http://catalog.northeastern.edu/course-descriptions/arch/
ARCH 2250. Introduction to Sustainable Design in Architecture. 4 Hours.
Explores the issues and practices of architectural design as it relates to natural systems, using critical readings of seminal and current texts, lectures, films, field trips, and projects that use both design and analysis as means of inquiry. Examines varied approaches to sustainable design, including using nature and wilderness as models; biophilia; biomimicry; material sources and reuse; accounting systems such as LEED, Zero Net Carbon, and the 2030 Challenge; and the Living Building Challenge. Course work couples these thematic explorations with projects that investigate the application of the ideas in built form. Designed to offer both a broad understanding of sustainable design and a deep understanding of the varied ways one might approach green as a design professional.

ARCH 2260. Introduction to Building Systems. 4 Hours.
Introduces fundamentals of building technology and explores technology as means and manifestation of architecture in the world. Using a systems approach, studies the interactions among natural forces, material properties, technological capabilities, and human cultural values and the ways these relationships give rise to architecture. Considers a series of physical principles—including gravity, moisture, heat, light, and air—to reveal specific architectural possibilities and material responses. Explores the ways design shapes the interaction of materials and forces to provide for human safety, shelter, comfort, and delight through a combination of hands-on workshops, seminal readings, and design exercises.

ARCH 5230. Structural Systems. 4 Hours.
Introduces the fundamental concepts of structural analysis and design for architecture. Examines the nature of forces and their effects on different types of structural elements; the structural properties of shapes and materials; and the selection, analysis, and design of efficient structural systems that resist the loads acting upon them. Uses historical and contemporary examples to illustrate how the changing context of architectural ideas drives structural form and the selection of structural systems. Includes field trips and student presentations of structural models and diagrams. Restricted to students in the architecture BS program and to students in the three-year MArch program.

Bioengineering
http://catalog.northeastern.edu/course-descriptions/bioe/
http://www.bioe.neu.edu/

BIOE 2350. Biomechanics. 4 Hours.
Designed to acquaint students with concepts of stress, strain, and constitutive laws as applied to problems in biomechanics. Introduces rigid body and deformable body mechanics. Focuses on basic foundations of solid mechanics using vectors and tensors. Illustrative examples from tissue and cell biomechanics are given where appropriate.

BIOE 3210. Bioelectricity. 4 Hours.
Discusses principles of circuits, signals, and systems in the context of operating principles of bioelectrical systems at multiple physiological scales. Offers students an opportunity to obtain the fundamental background required to interface biological systems with circuits and sensors for measurements. Covers fundamentals of structure and function of electrically active tissue including nerves, brain, and muscle, including heart.
Biology

http://catalog.northeastern.edu/course-descriptions/biol/

https://cos.northeastern.edu/biology/

BIOL 1141. Microbes and Society. 4 Hours.
Introduces the unseen world of microorganisms. Students analyze how the growth and behavior of this
diverse group of organisms affect many aspects of human society including agriculture and food
preparation; drug development and manufacture; liquid and solid waste management; genetic
engineering; geochemical cycles; and health and disease.

BIOL 1143. Biology and Society. 4 Hours.
Offers an overview of how biology weaves its way across a broad spectrum of complex societal issues.
Introduces students to the biological mechanisms and processes responsible for genetic inheritance,
energy transfer, evolution, and population dynamics, providing a framework within which students may
critically interpret and discuss important biological information provided in public forums. Seeks to
empower students to make informed choices at the policy and personal levels. Offers students an
opportunity to acquire an understanding of the basic principles of biology and apply the scientific process
to the analysis of contemporary issues. Using a thematic approach, covers a wide range of issues
including the reemergence of plagues, biological weapons and security, the environment, and human
health and wellness.

BIOL 5583. Immunology. 4 Hours.
Provides an overview of the structure and function of genes, proteins, and cells involved in the generation
of the immune response. Emphasis is on molecular immunology and immunogenetics.

Biotechnology

http://catalog.northeastern.edu/course-descriptions/ biot/

https://cos.northeastern.edu/biotech/

BIOT 5810. Cutting-Edge Applications in Molecular Biotechnology. 3 Hours.
Introduces the uses of molecular biology in a biotechnology setting. Includes a brief review of the basics
and then dives into state-of-the-art molecular biology applications used in biotechnology today. These
applications include stability and expression of cloned gene products, gene cloning strategies, transgenic
species, mutation creation and analysis, DNA fingerprinting, PCR technology, microarray technology,
gene probes, gene targeting, gene therapy, stem cell technology, antisense RNA, CAR T-cell therapy,
RNA interference, and CRISPR/Cas9.

Chemical Engineering

http://catalog.northeastern.edu/course-descriptions/chme/
CHME 2320. Chemical Engineering Thermodynamics 1. 4 Hours.
Covers the first and second laws of thermodynamics and their application to batch and flow systems, heat effects in chemicals, and physical properties/real fluids. Applies basic principles and mathematical relations to the analysis and solution of engineering problems.

CHME 3322. Chemical Engineering Thermodynamics 2. 4 Hours.
Continues CHME 2320. Covers thermodynamic properties of mixtures; fugacity and the fugacity coefficients from equations of state for gaseous mixtures; liquid phase fugacities and activity coefficients for liquid mixtures; phase equilibriums; the equilibrium constant for homogeneous gas-phase reactions; and extension of theory to handle simultaneous, heterogeneous, and solution reactions.

CHME 5160. Drug Delivery: Engineering Analysis. 4 Hours.
Focuses on engineering analysis of drug delivery systems, demonstrating the application of classic engineering principles to a nontraditional field for chemical engineers. Presents quantitative analysis of transport of a drug through the body and its control by physical and chemical drug and drug delivery device properties. Emphasizes the influence of biological tissue composition and structure on these processes.

Civil and Environmental Engineering

CIVE 1200. How Cities Work: Experiencing Urban Infrastructure. 4 Hours.
Explores the networks that underpin the very existence of cities: our urban infrastructure. Designed as a grand tour of the engineering marvels that exist beneath our feet but whose operation is critical to urban dwellers, using Boston as our guide. Offers students an opportunity to study a new infrastructure system, first by learning and discussing the engineering principles behind its design and operation, and then by experiencing our local infrastructure through visits to local operation centers, city officials, and private contractors that manage and maintain them. Topics include transportation, energy, telecommunications, water and wastewater, food processing and distribution, and waste management. Explores how our infrastructure is interconnected and how this leads both to resilience and to fragility in the face of natural and anthropogenic disruptions.

CIVE 2221. Statics and Strength of Materials. 4 Hours.
Introduces solid mechanics including properties of areas and volumes (centroidal axes, moments of inertia, and so on), equilibrium of particles and rigid bodies in two and three dimensions, analysis of internal forces in trusses and simple frames, shear and moment diagrams in beams, computation of stresses induced by moment, shear and torque, and mechanical properties of materials.

CIVE 2320 Structural Analysis 1
Covers shear stresses in beams, combined stress analysis (bars with axial load plus shear and bending), introduction to buckling, influence lines (application to statically determinate systems), computation of
deflections (statically determinate systems), and analysis of indeterminate structures using the flexibility method and moment distribution.

**CIVE 2331. Fluid Mechanics. 4 Hours.**
Introduces the principles of fluid mechanics and the applications in basic hydraulic engineering systems. Topics include properties of fluids; pressure and force on surfaces and submerged bodies; continuity, momentum, and energy conservation principles; dimensional analysis and hydraulic similitude; flow in closed conduits; steady flow in pipe networks; unsteady flow in pipes; flow in open channels; hydraulic machines; and hydraulic structures. The laboratory component includes demonstrations and experiments to show the applicability of fluid mechanics and hydraulics principles.

**CIVE 2334. Environmental Engineering 1. 4 Hours.**
Focuses on protection and management of the environment. Topics include assessment of environmental quality; introduction to water and wastewater treatment technologies; air pollution control; and solid waste management.

**CIVE 2335. Environmental Engineering Chemistry. 4 Hours.**
Covers chemistry principles required for describing chemical processing of elements in natural systems, the distribution of pollutants in the environment, and chemical use in engineered treatment systems. Focuses on equilibrium thermodynamics and equilibria for acid-base, gas-water, precipitation-dissolution, metal complexation, oxidation-reduction, and sorption reactions. Discusses specific applications to pollutant reactions in surface waters, ground waters, soils, drinking water treatment, wastewater treatment, and the atmosphere.

**CIVE 3425. Steel Design. 4 Hours.**
Concentrates on design of steel members subject to tension, compression, bending, and combinations of loading, and design of connections, braced frames, and rigid frames. Design is based on the latest load resistance factor specifications of the American Institute for Steel Construction code. The theoretical basis of code formulas is also emphasized.

**CIVE 3430. Engineering Microbiology and Ecology. 4 Hours.**
Introduces the importance of microorganisms and plants to the natural and built environments, including global biogeochemical cycles, ecosystem composition and stability, and engineering applications. Seeks to provide a fundamental understanding of microorganisms (metabolisms, growth, genetics, resource requirements, and niche) and their role in the global ecosystem (element cycling, energy flows, food webs). Examines the role of plant microbes in both engineered and nature systems for beneficial environmental applications and bidirectional interactions between the natural and the built environment through a series of case studies that highlight the challenges of and strategies for engineering in the earth system context, such as microbially mediated infrastructure corrosion, ecological effects of nutrient pollution, bioaccumulation, green infrastructure and remediation (constructed wetlands, bioremediation), and wastewater treatment.

**CIVE 3435. Environmental Pollution Fate and Transport. 4 Hours.**
Provides a systematic approach to analyzing the fate and transport of pollutants within natural systems. Equilibrium modeling and reactive transport modeling are used to assess the predominant processes that control the movement and persistence of pollutants in water, soil, and air. Topics include mass transfer across multiple phases; physical, chemical, and biological transformations of substances; transport
processes (diffusion, dispersion, advection, interphase mass transport); eutrophication of lakes; conventional pollutants in rivers and estuaries; groundwater contamination; and atmospheric deposition.

CIVE 4540. Resource Recovery and Waste Treatment Technologies Abroad. 4 Hours.
Examines different aspects relative to municipal and industrial solid waste, with a special focus on material recovery. Covers chemical-physical characterization of waste, source reduction and toxicity, recycling and selection of different fractions, resource and energy recovery (e.g., composting, anaerobic digestion, combustion to energy), and analysis and preliminary design of treatment disposal options. Through design projects, offers students an opportunity to apply lessons learned to the U.S. context. Taught in a study-abroad format in a European nation.

CIVE 4777. Climate Hazards and Resilient Cities Abroad. 4 Hours.
Focuses on the science of “global weirding”—unprecedented changes in weather caused by global warming and natural climate variability. Introduces the physical-science basis of climate, computer models of the earth system, statistical tools for the analysis of climate model, and remote sensor data. Also introduces the concept of urban resilience, focusing on preventing natural hazards from turning into catastrophic disasters in densely populated and vulnerable regions. Examines multifaceted aspects of resilience, including governance, emergency response, infrastructural, informational, social, and policy aspects. Encourages students to consider the science, engineering, and policy challenges in transforming vulnerable urban and coastal regions to climate-resilient cities and to examine how societies can learn from each other by comparing Boston with the country visited. Taught abroad.

CIVE 4778. Climate Adaptation and Policy Abroad. 4 Hours.
Explores how the country visited plans to adapt to climate change and natural hazards and how that country participates in international climate and emissions negotiations, within the context of its history and culture. Focuses on how an emerging economy adjusts to the reality of climate change/extremes and how citizens may drive decisions and policy. Incorporates topics from climate change, environmental sciences, civil and chemical engineering, remote sensing, social sciences, electrical engineering, computer science, and the management sciences. Encourages students to think about possible policy lessons for the United States. Offers students an opportunity to visit key sights. Culminates with a mock “climate change war game,” simulating an event in which international negotiators meet to formulate treaties on climate change adaptation and mitigation. Taught abroad.

CIVE 5250. Organic Pollutants in the Environment. 4 Hours.
Introduces principles that govern the fate and transport of organic chemicals released to the environment. Topics include chemical structure and thermodynamic properties and how they predict physical processes that control the distribution of contaminants between the atmosphere, fresh and marine surface waters, groundwater, soils, sediments, and biota. Introduces models and methods for predicting fate and transport of organic contaminants within and between environmental media, including molecular diffusion, transport across boundaries, and box models. Explores concepts linking environmental chemistry with ecotoxicology, including bioaccumulation, food web models, and risk assessment. Uses case studies and real-world scenarios to illustrate concepts. Prereq: (a) Either CHEM 1151 or CHEM 1211 and junior or senior standing or (b) graduate standing.

CIVE 5261. Dynamic Modeling for Environmental Investment and Policymaking. 4 Hours.
Introduces the theory, methods, and tools of dynamic modeling for policy and investment decision making, emphasizing environmental issues. Makes use of state-of-the-art computing methods to translate theory and concepts into executable models and offers extensive hands-on modeling experience. Topics include management of discrete flows (e.g., models of traffic systems); discounting, intertemporal optimization (e.g., models of resource extraction); dynamic games (e.g., models for adaptive management); and treatment of risk, uncertainty, novelty, and complexity (e.g., for investment and policymaking).

**CIVE 5280. Remote Sensing of the Environment. 4 Hours.**
Introduces remote sensing techniques, including obtaining, visualizing, and analyzing satellite data. Examines physical processes, methods, and data products used in satellite remote sensing of the Earth’s environment. Topics include active and passive remote sensing methods based on fundamentals of electromagnetic radiation, concepts used to develop data products from the remotely sensed measurements, and a suite of satellite data products to investigate current and past conditions of the Earth’s terrestrial and ocean surfaces. Uses geographic information systems (GIS) and student-developed programs to view and interpret satellite data. Knowledge of GIS, R, and Python is preferred.

**CIVE 5373. Transportation Planning and Engineering. 4 Hours.**
Discusses urban transportation planning and engineering for modes other than highway. Covers travel demand forecasting for both the short and long term including impact analysis methods, simple elasticity models, and the four-step model system of trip generation, trip distribution, modal split, and network assignment. Introduces transit service analysis and design. Other topics include capacity, service, and engineering design basics for different travel modes, such as bus, airport, rail, and bicycle. Considers the environmental impact, economic evaluation, and financial impact of different modes of transportation.

**CIVE 7110. Critical Infrastructure Resilience. 4 Hours.**
Introduces the concept of resilience by exploring engineering concepts and perspectives to offer students an opportunity to develop the ability to be prepared for and adapt to challenging situations and scenarios—e.g., globalization, climate change, security threats, and natural disasters—on critical infrastructures and key resources. Topics include application of tools for infrastructure modeling and risk assessment; identification of natural and man-made hazards; management of disaster risks and communications; resilience design; and future challenges, policy, and novel approaches to advance resilience. Explores application to real-life examples through group projects. Requires one semester of undergraduate statistics.

**CIVE 7252. Water Engineering, Resources, and Energy Recovery. 4 Hours.**
Covers theory and design principles of major water and wastewater treatment processes. Focuses on the emerging issues in water sustainability and advances in fundamental science and technology in integrating scientific principles, engineered processes, and systems analyses to address diverse challenges related to society’s growing water needs and their nexus with energy and the environment. Designed to stimulate multidisciplinary thinking and research among traditional areas of civil and environmental engineering, biology, chemistry, modeling, data science, and others. Special projects are designed to have students working in multidisciplinary teams to develop sustainable solutions to meet the present and future water and resources needs of the society. Given current conditions, innovative approaches and creative energy solutions for self-sustaining wastewater treatment facilities are needed. Requires one semester of undergraduate chemistry or one semester of undergraduate biology.
CIVE 7261. Surface Water Quality Modeling. 4 Hours.
Examines mechanisms through which environmental water quality becomes degraded, control strategies for mitigating degradation, and resource management strategies for preventing degradation. Topics include contaminant sources, eutrophication processes, environmental transport and transformation processes, water quality measurements and monitoring, contaminant fate and transport modeling in lakes, rivers, estuaries, and ground water, water quality control methods and strategies, and water resource protection regulations and strategies.

CIVE 7263. Groundwater Quality Modeling. 4 Hours.
Examines methods and models used to evaluate flow and contaminant transport in ground water, focusing on practical applications. Topics in ground water flow include one-dimensional flow, well hydraulics, aquifer parameter tests, unsaturated zone flow, seepage from canals and ditches, seepage through earth structures, and an introduction to aquifer modeling. Topics in ground water quality include chemical transport and transformation processes, chemical fate and transport modeling in ground water, and ground water quality measurement and monitoring. Studies solution methods that focus on analytical solutions and flow nets, with an introduction to numerical methods. Also discusses ground water quality control and resource protection methods, strategies, and regulations.

CIVE 7272. Air Quality Management. 4 Hours.
Explores engineering theory and practice related to air resources management. Focuses on modeling dispersion and reactions for atmospheric pollutants and on analysis of systems for controlling gaseous and particulate emissions including dry collection, wet collection, absorption, and catalytic processes. Also addresses biological and chemical aspects of air pollution including toxicological issues, physiological effects of aerosols, analysis of organic and inorganic constituents of the atmosphere, and rationale for establishing air quality criteria and standards. Requires one semester of undergraduate chemistry.

CIVE 7312. Earthquake Engineering. 4 Hours.
Studies plate tectonics, seismology, faults and characteristics, ground motions, seismic hazard analysis, dynamic response of single degree-of-freedom system, response spectrum, site effects, and seismic design considerations for buildings, bridges, and earth-retaining structures. Requires one semester of undergraduate statics.

CIVE 7340. Seismic Analysis and Design. 4 Hours.
Considers the response of linear systems to coherent and incoherent support motion, nonlinear response, the concept of ductility, inelastic response spectra, soil-structure interaction, random vibration theory, development of seismic codes, and characterizations of earthquakes for design.

CIVE 7341. Structural Reliability. 4 Hours.
Examines applications of probability theory and random variables for determining the reliability of structures. Includes the following topics: formulation of reliability for structural components and systems; first-order second-moment method, first- and second-order reliability methods, and simulation methods; analysis of model uncertainty and Bayesian parameter estimation technique; load and resistance models and bases for probabilistic structural codes; and time-dependent reliability methods. Assumes no prior knowledge of probability theory.

CIVE 7350. Behavior of Concrete Structures. 4 Hours.
Considers flexural mechanics of reinforced concrete cross sections and members; combined bending, axial, and shear loads; advanced topics in shear, torsion, and connection design; and application of plastic analysis to reinforced concrete frames, their behavior under cyclic loading, and response of structures under seismic actions. Requires one semester of undergraduate concrete design.

**CIVE 7351. Behavior of Steel Structures. 4 Hours.**
Studies the behavior and design of steel structural systems, including structural stability; advanced topics in mechanics and design of structural steel members, including combined axial, flexure, and shear loads; composite steel/concrete beam and column behavior and design; plate girders; and advanced topics in connection design. Requires one semester of undergraduate steel design.

**CIVE 7354. Wind Engineering. 4 Hours.**
Covers atmospheric circulation, atmospheric boundary layer winds, bluff-body aerodynamics, introduction to random vibration theory, response of structures to fluctuating wind loads, aeroelastic phenomena, wind-tunnel and full-scale testing, nonsynoptic winds (hurricanes, tornadoes, etc.), wind-load standards, and design applications.

**CIVE 7355. Advanced Bridge Design. 4 Hours.**
Studies the behavior and design of prestressed concrete bridges. Includes conceptual design, flexural design, shear design, and torsional design of prestressed elements. Analyzes indeterminate prestressed structures and design for prestressed concrete bridges, including material properties, loads, reinforcement, structural analysis, temperature effects, and construction methods. Covers solid slab, T-beam, and box girders. Final projects include complete designs for a simple supported girder bridge and a continuous girder bridge using load factor and resistance design (LFRD) specifications. Requires one semester of undergraduate structural analysis.

Commerce and Economic Development

[http://catalog.northeastern.edu/course-descriptions/ced/](http://catalog.northeastern.edu/course-descriptions/ced/)


**CED 6120. Environmental Economics. 4 Hours.**
Analyzes efficient allocation of environmental resources and the impact on commerce and economic development. Includes additional topics such as the negative impact of economic activities on air and water with consideration of effective public policy. Explores current issues—such as global warming, habitat and species protection, etc.—and requires consideration of worldwide approaches and solutions to international problems.

**CED 6130. Sustainable Economic Development. 4 Hours.**
Addresses the economics of balancing development and environmental impacts in the context of meeting current and future human needs while protecting the environment. Considers challenges and strategies in both developed and developing economies. Beginning with the market failure resulting from not including environmental impacts in cost calculations, this course explores the competing models of economic development, the environment, and population growth.
COMM 1125. Science, Communication, and Society. 4 Hours.
Introduces the major areas of research analyzing the role of communication and the media in shaping
debates over science, technology, and the environment. Focuses on what U.S. National Academies calls
the “science of science communication” to offer students an opportunity to acquire the knowledge
necessary to assess the interplay between science, engineering, and society, including the implications
for strategic communication, public engagement, personal decisions, and career choices. Examines the
scientific, social, and communication dimensions of debates over climate change, evolution, human
genetic engineering, childhood vaccination, food biotechnology, and other case studies. Covers how to
find, discuss, evaluate, and use expert sources of information; to formulate research questions and
expectations; to think effectively about professional situations and choices; and to write evidence-based,
persuasive papers and essays.

COMM 1255. Communication in a Digital Age. 4 Hours.
Covers digital communication’s history, technical basis (“protocol” and the “Web”), communicative
effects, commercial applications, culture, and societal interactions. Digital communication is central to
contemporary life and is (consequently) often taken for granted, which this course seeks to remedy.
Applies practical skills relative to theories about collaboration and cultural production and engagement
with and analyses of online cultures. Offers students an opportunity to become effective online
communicators—using practical exercises such as email filtering, online collaboration, and writing in a
Web markup format—and to make use of critical thinking to understand and engage with issues such as
online privacy, gender and racial bias, and marketplace credibility and fraud.

COMM 1412. Social Movement Communication. 4 Hours.
Examines the communication strategies (including rhetorical messaging, public advocacy, grassroots
organizing, fund-raising, and media outreach) of historical and contemporary advocacy groups,
movements, and organizations. Social movements considered may include immigration protests, AIDS
activism, environmental advocacy, disability movements, and animal-rights “terrorism.”.

COMM 2303. Global and Intercultural Communication. 4 Hours.
Focuses on theories of and approaches to the study of intercultural communication. Emphasizes the
importance of being able to negotiate cultural differences and of understanding intercultural contact in
societies and institutions. Stresses the benefits and complexities of cultural diversity in global, local, and
organizational contexts.

COMM 2551. Free Speech in Cyberspace. 4 Hours.
Examines the extension of communication law to the Internet, assesses a range of pending proposals
designed to regulate free speech in cyberspace, and discusses a variety of national and international
schemes intended to govern the developing global information infrastructure. Considers free speech
-political speech, sexually explicit expression, and defamation); intellectual property (trademark and
copyright); and emerging issues (privacy, unsolicited commercial email or spam, schools, and
Does not cover issues related to electronic commerce or contracts, gambling, personal jurisdiction, or Internet taxation.

COMM 3304. Communication and Inclusion. 4 Hours.
Explores theoretical and practical issues in the relationships between communication, social identity, and social inclusion. Focuses on how communication shapes perceptions and positions of salient social identity groups and how individuals and groups resist and transform identity and promote inclusion through communication. Specifically focuses on communication and inclusion in the contexts of gender, race, sexual identity, social class, ability, and age. Course topics cover a range of theoretical and practical issues, including diversity in organizational settings and the social construction of identity. COMM 3304 and WMNS 3304 are cross-listed.

COMM 3320. Political Communication. 4 Hours.
Reviews the construction and influence of rhetoric in political campaigns, particularly contemporary presidential campaigns. Also studies the impact of mass communication on the outcome of elections. Offers students an opportunity to analyze artifacts from recent political campaigns such as stump speeches, campaign debates, campaign advertising, and formal campaign speeches such as nomination acceptance addresses, concession and victory speeches, and inaugural addresses.

COMM 4631. Crisis Communication and Image Management. 4 Hours.
Examines theories, models, and strategies related to crisis communication and establishes ethical principles regarding what, how, and when essential elements must be employed for effective and ethical crisis communication. Offers students an opportunity to learn how to distinguish between an incident and crisis; to analyze communication practices and methods applied during a crisis; to apply social scientific theory to explain how and why a crisis occurred; and to draw upon theory to develop effective crisis communication plans. Assesses responses to crises using ethical principles such as transparency, two-way symmetrical communication, and timing. Designed to prepare communication professionals who appreciate the need for responsible advocacy when responding to crises.

Computer Science

http://catalog.northeastern.edu/course-descriptions/cs/

https://www.ccis.northeastern.edu/

CS 2550. Foundations of Cybersecurity. 4 Hours.
Presents an overview of basic principles and security concepts related to information systems, including workstation security, system security, and communications security. Discusses legal, ethical, and human factors and professional issues associated with cybersecurity, including the ability to differentiate between laws and ethics. Offers students an opportunity to use a substantial variety of existing software tools to probe both computer systems and networks in order to learn how these systems function, how data moves within these systems, and how these systems might be vulnerable. Covers security methods, controls, procedures, economics of cybercrime, criminal procedure, and forensics.

CS 3740. Systems Security. 4 Hours.
Introduces the fundamental principles of designing and implementing secure programs and systems. Presents and analyzes prevalent classes of attacks against systems. Discusses techniques for identifying the presence of vulnerabilities in system design and implementation, preventing the introduction of or
successful completion of attacks, limiting the damage incurred by attacks, and strategies for recovering
from system compromises. Offers opportunities for hands-on practice of real-world attack and defense in
several domains, including systems administration, the Web, and mobile devices. Presents the ethical
considerations of security research and practice.

CS 4100. Artificial Intelligence. 4 Hours.
Introduces the fundamental problems, theories, and algorithms of the artificial intelligence field. Includes
heuristic search; knowledge representation using predicate calculus; automated deduction and its
applications; planning; and machine learning. Additional topics include game playing; uncertain reasoning
and expert systems; natural language processing; logic for common-sense reasoning; ontologies; and
multiagent systems.

CET 4210. Robotics. 3 Hours.
Covers the theory and practice of robotics. Topics include kinematics, dynamics, position and orientation,
trajectories, coordinate frames, navigation, closed-loop control, obstacle detection, manipulation of
objects, actuators, sensors, systems modeling, analysis, motion control, and techniques for programming
robots. Offers students an opportunity to obtain practical experience in constructing and programming a
robot system.

CET 4230. Computer and Network Security. 3 Hours.
Covers the principles and practice of computer and network security. Topics include the history of
security; encryption techniques and applications; secure communications; software protection;
vulnerabilities of networks, operating systems, databases, and distributed systems; security standards;
security applications; security attacks; malicious software; intrusion detection; firewalls; and user
authentication. Surveys legal and ethical concepts, including integrity, confidentiality, authenticity,
accountability, and availability.

CS 4610. Robotic Science and Systems. 4 Hours.
Introduces autonomous mobile robots, with a focus on algorithms and software development, including
closed-loop control, robot software architecture, wheeled locomotion and navigation, tactile and basic
visual sensing, obstacle detection and avoidance, and grasping and manipulation of objects. Offers
students an opportunity to progressively construct mobile robots from a predesigned electromechanical
kit. The robots are controlled wirelessly by software of the students’ own design, built within a provided
robotics software framework. The course culminates in a grand challenge competition using all features of
the robots.

CS 4740. Network Security. 4 Hours.
Studies topics related to Internet architecture and cryptographic schemes in the context of security.
Provides advanced coverage of the major Internet protocols including IP and DNS. Examines denial of
service, viruses, and worms, and discusses techniques for protection. Covers cryptographic paradigms
and algorithms such as RSA and Diffie-Hellman in sufficient mathematical detail. The advanced topics
address the design and implementation of authentication protocols and existing standardized security
protocols. Explores the security of commonly used applications like the Web and e-mail.

CS 4940. Research Projects on National Security. 4 Hours.
Engages students in national cybersecurity/information systems security problems. Offers students an
opportunity to learn how to apply research techniques, think clearly about these issues, formulate and
analyze potential solutions, and communicate their results. Working in small groups under the mentorship
of external mentors from government and industry, each student has an opportunity to formulate, carry out, and present original research on current cybersecurity/information assurance problems of interest to the nation. As part of this research, students are required to submit a written proposal about the project, complete with motivation, literature research, and reasons for the study; create a work plan for the research problem; and create a final report.

**CS 5340. Computer/Human Interaction. 4 Hours.**
Covers the principles of human-computer interaction and the design and evaluation of user interfaces. Topics include an overview of human information processing subsystems (perception, memory, attention, and problem solving); how the properties of these systems affect the design of user interfaces; the principles, guidelines, and specification languages for designing good user interfaces, with emphasis on tool kits and libraries of standard graphical user interface objects; and a variety of interface evaluation methodologies that can be used to measure the usability of software. Other topics may include World Wide Web design principles and tools, computer-supported cooperative work, multimodal and “next generation” interfaces, speech and natural language interfaces, and virtual reality interfaces. Course work includes both the creation and implementation of original user interface designs, and the evaluation of user interfaces created by others. Requires knowledge of C programming language/UNIX.

**CS 6740. Network Security. 4 Hours.**
Studies the theory and practice of computer security, focusing on the security aspects of multiuser systems and the Internet. Introduces cryptographic tools, such as encryption, key exchange, hashing, and digital signatures in terms of their applicability to maintaining network security. Discusses security protocols for mobile networks. Topics include firewalls, viruses, Trojan horses, password security, biometrics, VPNs, and Internet protocols such as SSL, IPSec, PGP, SNMP, and others.

**CS 6760. Privacy, Security, and Usability. 4 Hours.**
Challenges conventional wisdom and encourages students to discover ways that security, privacy, and usability can be made synergistic in system design. Usability and security are widely seen as two antagonistic design goals for complex computer systems. Topics include computer forensics, network forensics, user interface design, backups, logging, economic factors affecting adoption of security technology, trust management, and related public policy. Uses case studies such as PGP, S/MIME, and SSL. Introduces basic cryptography and hash function as it is needed. Course work includes analysis of papers, problem sets, and a substantial term project.

**Data Science**

[http://catalog.northeastern.edu/course-descriptions/ds/](http://catalog.northeastern.edu/course-descriptions/ds/)

[https://www.ccis.northeastern.edu/research-area/data-science/](https://www.ccis.northeastern.edu/research-area/data-science/)

**DS 4200. Information Presentation and Visualization. 4 Hours.**
Introduces foundational principles, methods, and techniques of visualization to enable creation of effective information representations suitable for exploration and discovery. Covers the design and evaluation process of visualization creation, visual representations of data, relevant principles of human vision and perception, and basic interactivity principles. Studies data types and a wide range of visual data encodings and representations. Draws examples from physics, biology, health science, social science, geography, business, and economics. Emphasizes good programming practices for both static
and interactive visualizations. Creates visualizations in Excel and Tableau as well as R, Python, and open web-based authoring libraries. Requires programming in Python, JavaScript, HTML, and CSS. Requires extensive writing including documentation, explanations, and discussions of the findings from the data analyses and the visualizations.

Criminal Justice

http://catalog.northeastern.edu/course-descriptions/crim/

https://cssh.northeastern.edu/sccj/

CRIM 3400. Corporate Security: Securing the Private Sector. 4 Hours.
Examines the history and evolution of security from a focus on crime prevention to one of loss prevention for business, industry, institutions, and government. Emphasizes the need for analytical, interpersonal, and communications skills in developing cost-effective programs for the protection of assets, personnel, and third parties. Discusses the security/government relationship.

CRIM 4800. Crime Mapping. 4 Hours.
Designed as a practical and hands-on introduction to various GIS techniques. Offers students an opportunity to obtain an understanding of how geographic information systems (GIS) are used by law enforcement agencies. Covers tools that provide a more complete understanding of crime locations and explores how criminological theory and geographic information together can be used to develop crime prevention/reduction strategies. Focuses on the strengths and limitations of various criminological perspectives, how they may be used to inform enforcement decisions, and how to use GIS applications to create maps that convey a clear message regarding the spatial distribution of a given criminal behavior.

CRIM 7270. Crime and Community Context. 4 Hours.
Provides an overview of crime in the context of communities. Covers major theoretical perspectives and introduces students to both major quantitative and ethnographic work on communities. Examines sociological aspects of community context and contrasts aspects of community processes that are implicated in either the generation or the prevention of crime. Considers current criminal justice practices and crime prevention approaches intended to address crime within communities—especially as they interact with neighborhood social processes in ways that deter or facilitate community crime.

Earth and Environmental Studies

http://catalog.northeastern.edu/course-descriptions/envr/

ENVR 1110. Global Climate Change. 4 Hours.
Analyzes Earth’s modern climate system and natural climate change over Earth’s 4.5-billion-year history. Examines ongoing and future climate change. Includes expected impacts of the predicted climate changes as well as mitigation and adaptation options.

ENVR 1120. Oceans and Coasts. 4 Hours.
Explores the marine and coastal realm and the problems that arise from the human-marine relationship. Begins by studying the history of the ocean and ends with how to create a more sustainable marine world. Topics covered include ocean and estuarine circulation, climate change and ocean response, and
the plant and animal life thriving in different parts of the ocean. Includes reading and analyzing the scientific literature, developing and presenting research projects, and group work.

**ENVR 3125. Global Oceanic Change. 4 Hours.**
Explores major changes in physical, biological, and chemical properties of the ocean over geological and human timescales. Includes origin and early evolution of the oceans; sea-level change; global warming; ocean acidification; the role of plate tectonics in driving long-term oceanic change; the role of atmospheric carbon dioxide in driving short-term oceanic change; tipping points in the oceans; snowball earth theory; marine pollution; oil exploration; and social, economic, and political implications of global oceanic change. Themes include differentiating drivers of change across multiple temporal and spatial scales; evaluating change from different and sometimes conflicting perspectives (social, economic, political, environmental); differentiating local and global change; and establishing linkages between physical, chemical, and biological processes in the ocean. Requires prior completion of one laboratory science course or permission of instructor.

**ENVR 3200. Water Resources. 4 Hours.**
Offers students who wish to work in the area of water resources an opportunity to understand the issues related to water’s availability and behavior at the Earth’s surface. Topics covered include (1) the hydrologic cycle, including global and regional patterns of water movement; (2) characteristics of surface and groundwater systems, including the linkage between streams, rivers, lakes, wetlands, groundwater, and the sea; (3) water management issues and regulations that have been enacted to control the use of water as a resource; (4) water quality measures for surface water and groundwater; and (5) examples of water use conflicts and emerging water issues. Case studies include examples from California, New England, New York, the southwestern United States, China, Africa, and the Middle East.

**ENVR 4504. Environmental Pollution. 4 Hours.**
Surveys pollution in our atmosphere, on land, and in our oceans. Offers students an opportunity to develop the skills to understand the sources, processes, and fate of environmental contaminants in surface and groundwater, soils, sediment, and biota, with special focus on organic contaminants. Links environmental chemistry with ecotoxicology through an understanding of bioaccumulation, food web models, and risk assessment. Uses case studies and real-world scenarios to illustrate important concepts. Emphasizes innovative solutions for pollution remediation. Discusses current pollution issues and how to clearly communicate these issues to a broad audience. Students who do not meet course prerequisites may seek permission of instructor.

**ENVR 4515. Sustainable Development. 4 Hours.**
Focuses on the development of communities in an environmentally sustainable way and on the division of natural resources within these communities and the global system. Defines and discusses “sustainable development” and its global role today. Exposes students to a history of developmental methods while learning about the interconnectedness of development and the environment. Encourages students to draw conclusions about the environmental impacts of these methods and to consider more equitable uses of natural resources.

**ENVR 5400. Marine Science Policy and Ethics. 3 Hours.**
Offers ethics training for a critical review of marine policies in the following topical areas: marine environmental ethics (conservation and preservation), conflicts of interest/research integrity, human subjects/mammal protections, ethical challenges in marine science modeling, ethics of fishing governance (marine conservation and regulations), sustainability models for marine sciences, data
management, and new models of comanagement and community engagement with marine research. Reviews critical environmental policies affecting marine resources (NEPA, CERCLA, RCRA, Endangered Species, Marine Mammal Protection, and Oil Pollution acts, Magnuson-Stevens Act, etc.). Critically evaluates case studies and ethical review of coastal management for sustainability and pollution control, marine fisheries, and energy development.

**ESC 2200. Natural Disasters: Evaluating Risk, Minimizing Loss. 3 Hours.**
Integrates material from the core courses regarding a scientific understanding of how the Earth interacts violently with human-created environments. Focuses on actual vs. perceived risk and mitigation techniques.

*Ecology, Evolution and Marine Biology*

[http://catalog.northeastern.edu/course-descriptions/eemb/](http://catalog.northeastern.edu/course-descriptions/eemb/)

[https://cos.northeastern.edu/marinescience/research/behavioral-evolutionary-ecology/](https://cos.northeastern.edu/marinescience/research/behavioral-evolutionary-ecology/)

**EEMB 3460. Conservation Biology. 4 Hours.**
Explores conservation biology, an interdisciplinary science that focuses on conservation of biological diversity at multiple levels. Emphasizes the causes and consequences of biodiversity loss and demonstrates how ecological and evolutionary principles are applied to conservation problems. Covers sustainability; climate change; introduced species; conservation of threatened and endangered species; and pollution, disease, and habitat restoration using examples from marine, aquatic, and terrestrial systems. Offers students an opportunity to read, discuss, evaluate, and present data from primary research through written assignments and oral debates and to apply this knowledge to conservation issues. Emphasizes critical thinking, problem solving, and recognizing multiple perspectives.

**EEMB 3470. Coastal Ecology and Sustainability. 4 Hours.**
Designed to provide an integrated exposure to issues surrounding the ecology and sustainability of coastal and estuarine systems, with a particular focus on urban harbors. Exposes students to both the diversity and complexity of coastal habitats that exist both locally (salt marshes and seagrass beds) and globally (mangroves) and the mechanisms of estuarine and coastal functioning (geomorphology, biogeochemistry, microbial ecology, food webs, fisheries). Considers the ecosystem services provided by coastal systems and how those services are altered through human pressures.

**EEMB 5536. Ocean and Coastal Sustainability. 3 Hours.**
Offers students advanced training in the expanding field of sustainability, with a combined focus on the practical aspects of systems management and the theoretical understanding of whole-systems design and resiliency. Seeks to train future leaders capable of creating innovative solutions to sustainability issues at local and global levels. Key interdisciplinary themes discussed include the social and political aspects of ocean and coastal sustainability (i.e., education and communication), sustainable development and ecosystem stability, the impacts of climate change on ocean and coastal resilience, and the economic and entrepreneurial possibilities in the field of sustainability. Restricted to Three Seas students only.

*Economics*

[http://catalog.northeastern.edu/course-descriptions/econ/](http://catalog.northeastern.edu/course-descriptions/econ/)
ECON 3414. Economics of Human Capital. 4 Hours.
Explores theoretical and empirical treatment of economic issues related to investments in human capital including formal education (preschool through postsecondary), vocational education, on-the-job training, work experience and government-sponsored employment and training programs, and their impacts on individuals and society. Emphasizes studies of public policies to promote human capital investments including cost-effectiveness analysis and benefit-cost analysis for determining the effectiveness of investments in literacy, education, and training from a private and social standpoint.

ECON 3420. Urban Economic Issues. 4 Hours.
Studies urban growth and development, focusing on economic analysis of selected urban problems such as housing, poverty, transportation, education, health, crime, and the urban environment. Discusses public policies related to such problems.

ECON 3422. Economics of Transportation. 4 Hours.
Covers transportation and land-use patterns; externalities; special costs and social benefits of various modes of transportation, ownership, regulations, and financing of various modes of transportation; and economics of new technology in transportation.

ECON 3423. Environmental Economics. 4 Hours.
Applies the tools of economics to environmental issues. Explores taxonomy of environmental effects; externalities; the commons problem; taxation, regulations, marketable permits, and property rights as a solution; measuring benefits of cleaner air and water, noise abatement, and recreational areas; global issues including tropical deforestation and acid rain; and the relevance of economics to the environmental debate.

ECON 3425. Energy Economics. 4 Hours.
Introduces theoretical and empirical perspectives on energy demand and energy supply. Energy is vital to modern economies. Emphasizes the role markets play in determining how to use energy and its sources and the scope for public policy to address market imperfections. Discusses oil, natural gas, coal, nuclear power, and renewable energy (such as hydro-, wind, and solar power). Covers the public policy issues around greenhouse gas emissions and energy security.

ECON 7253. International Integration. 4 Hours.
Examines the evolution of global markets for goods, services, capital, and labor over the past two centuries, the stylized facts regarding trends in integration, the factors affecting the trends in integration, the linkages between integration of different markets, and the impact of integration on the dynamics of global development and disparities. The analysis follows an eclectic approach to the questions addressed, drawing upon different intellectual traditions in economics. Requires knowledge of intermediate microeconomic theory.

ECON 7260. Urban Economic Systems. 4 Hours.
Examines urban economic systems including systematic relationships among cities, as well as those within cities. The portion of the course devoted to intermetropolitan analysis covers central place theory, the location of economic activity, and intermetropolitan trade. Intrametropolitan analysis includes urban form and land use, land use controls, and local government systems.
ECON 7261. Urban Economic Development. 4 Hours.
Examines urban economic development processes. Topics include models and techniques for describing and evaluating urban economies; development strategies and tools; commercial, industrial, and housing development; and problems of poverty and housing.

ECON 7772. Public Policy Toward Business. 4 Hours.
Covers the three major facets of public policy toward business: antitrust, regulation, and privatization. Demonstrates how economic theory and evidence are brought to bear on practical questions of market failure and policies to remedy such failure. Topics include mergers, collusion and facilitating practices, predatory conduct, cost of service regulation, price caps and incentive regulation, deregulation, and public enterprise vs. privatization. Policies are analyzed for their rationale, techniques for implementation, and effects as measure in the context of actual experience in the United States and other countries.

Energy Systems
http://catalog.northeastern.edu/course-descriptions/ensy/
https://www.northeastern.edu/graduate/program/master-of-science-in-energy-systems-boston-5269/

ENSY 5100. Hydropower. 4 Hours.
Covers fundamentals of hydropowered development projects and their relevant design parameters. Emphasizes harnessing the hydro-energy potentials of both natural and man-made reservoirs. Reviews hydro- and electromechanical equipment and civil structure. Addresses selection procedure and design parameters of the equipment and structure.

ENSY 5200 Energy Storage Systems
Explores the various energy storage technologies, their working, and their practical applications. Focuses on the state-of-the-art review of current and most recent technologies. Offers students an opportunity to explore various innovations in the field of energy storage that can be helpful for fulfilling our current energy storage needs. Covers many different energy storage systems such as mechanical, chemical, electrochemical, thermal, thermochemical, etc.

ENSY 5300. Electrochemical Energy Storage. 4 Hours.
Covers the basics of electrode kinetics and thermodynamics as applied to electrochemical energy storage systems, as well as batteries and capacitors for traction and stationary power. Discusses the chemical structure of electrodes and electrolytes and practical battery construction.

ENSY 5400 Power Plant Design and Analysis
Reviews the fundamental laws of thermodynamics and balance equations for mass, energy, exergy, and entropy. Studies thermochemistry, chemical equilibrium, fuels and combustion, steam power plant cycle, gas turbine systems, thermo-economics, nuclear power plants, and energy recovery.

ENSY 5500 Smart Grid
Covers fundamentals of smart electric power grid. Covers definition, design criteria, and technology. Smart grid can be defined as the application of information processing and communications to the power grid. Seeks to motivate development of the smart grid, evaluating options for adding sensing, communications, computation, intelligence, control, and automation to various parts of the electric
system. Topics include automation, or lack thereof, in existing power systems; generation; transmission; distribution; and smart grid definition.

Entrepreneurship

http://catalog.northeastern.edu/course-descriptions/entr/
http://www.damore-mckim.northeastern.edu/academic-programs/undergraduate-programs/concentrations/entrepreneurship-and-innovation

ENTR 2206. Global Social Enterprise. 4 Hours.
Designed to provide students with an in-depth exposure to entrepreneurship in the social sector, a rapidly growing segment of the global economy. Uses the case method to expose students to leading entrepreneurs who have developed and implemented business models to solve social problems such as extreme poverty, disease, illiteracy, and economic and social dislocation. Focuses on uniquely creative and driven people who have dedicated their lives to making a difference in the lives of others through values-based entrepreneurship.

ENTR 2414. Social Responsibility of Business in an Age of Inequality. 4 Hours.
Studies how businesses can be agents for social good, both locally and around the world. In an era of growing social and economic inequality both in the United States and globally, many “enlightened” businesses are reconsidering their roles in creating opportunity for disadvantaged or marginalized people and communities. Focuses on businesses that have the resources to invest in innovative social responsibility programs that address the impact of rising social and economic inequality. Considers the tension between the single-minded notion of maximizing profit for investors and serving a broader stakeholder community. The role of entrepreneurship and entrepreneurial thinking plays a key role in student learning. This is an integrative course that includes areas such as business policy, governance, strategy, and decision making.

ENTR 3212. Innovation for Social Change. 4 Hours.
Examines three fundamental principles of social innovation—user-centered design, integrated systems thinking, and impact measurement—and applies them to corporate, nonprofit, government, and philanthropic contexts. Through case teaching, multidisciplinary project-based learning, guest speakers, and design research, exposes students to leading ideas and policy perspectives from various sectors and regions. Seeks to embolden student commitment to creative problem-solving approaches that transcend silos and sectors. A final team project is formulated and designed with local partners, including an implementation strategy with investors that addresses the toughest problems confronting human society involving water, food, energy, education, housing, and security for marginalized and vulnerable populations.

ENTR 3306. Global Entrepreneurship. 4 Hours.
Offers an opportunity to learn how entrepreneurs start, finance, and manage small businesses. Includes a field experience in South Africa, which involves identifying startups and small business for assistance in developing a business plan and seeking debt and/or equity financing. Students have an opportunity to consider the unique challenges encountered by entrepreneurs in economically disadvantaged communities and the additional challenges presented by South Africa’s history of racism and its current struggles with HIV/AIDS. Teaches students the basic concepts and tools associated with small business management, such as preparing financial models and a written business plan and investment
presentation, with the goal that they can provide meaningful consulting assistance to township entrepreneurs.

**ENTR 3310. Entrepreneurship and Social Ventures. 4 Hours.**
Offers students an opportunity to design the “business model” for a solution to a social problem, emphasizing how the enterprise can become self-supporting without government grants or charitable contributions. Social entrepreneurs combine the knowledge and skills used in traditional business, with a passionate commitment to having a meaningful and sustainable social impact. The most successful social enterprises solve important social problems through disruptive innovation and business models, and their greatest challenge is to not just solve social problems but to create an economic engine within the business to insure long-lasting sustainability. Through discussion, debate, and critical thinking, students identify core concepts of entrepreneurship in the social context and create a unique opportunity to apply classroom concepts to real-world problems through group projects.

**ENTR 3520. Impact Investing and Social Finance. 4 Hours.**
Explores impact investing, a transformative way to work with money to achieve a more inclusive and sustainable economy. Large investors are entering the world of impact investing, a rapidly emerging space where social and ecological effects of finance are championed over maximizing shareholder value. New investment vehicles such as social impact bonds and Web exchanges are changing the role of financing institutions to better serve the needs of low-income populations around the world. Applies interdisciplinary frameworks, tools, and cases, with hands-on teamwork and guest speakers, to critically examine the field. Offers students an opportunity to learn to develop and test concepts that integrate social responsibility, sustainability, and mutual accountability into current financial and economic systems while expanding social capital markets.

*Geographic Information Systems (GIS)*

http://catalog.northeastern.edu/course-descriptions/gis/

*Global Studies*

http://catalog.northeastern.edu/course-descriptions/gst/

https://cssh.northeastern.edu/csgs/

**GST 6102 Global Corporate and Social Responsibility**

Examines the social responsibilities of corporations and individuals in the global twenty-first century. Topics may include outsourcing, offshoring, international labor laws, global environmental responsibility, global human rights, global citizenship, and sustainable development. Focuses on the use of qualitative and quantitative methods in the analysis of current policies and practices of multinational corporations, nation-states, and international non-governmental organizations.

**GST 6210. The Developers. 4 Hours.**
Focuses on the community-based groups and movements that shape popular opinion about and activism in response to living in a global world. Beginning with the social movement concept, the course examines
the emergence of a global civil society that operates on a dynamic of advocacy and development mobilized by grassroots-based economic organizations and individuals.

**GST 6220. Globalization of Emerging Economies. 4 Hours.**
Examines the rising status and influence of countries categorized as “emerging economies” and whether this status is sufficient to make them a viable long-term challenge to U.S. political and economic power. Some are significant regional players. Collectively, they are seen as challenging U.S. hegemony in their region and beyond, and they have called for a larger role in global decision making for the developing world. Analyzes how these emerging economies become a potent force in the global economy and their impact on various stages of the international arena. Discussions may include a review of specific regional impacts, implications for international security, and effects on international aid policies.

**GST 6300 Terrorism and Security**
Examines the issues of security and terrorism in relation to globalization. Covers the objectives of terrorism and the implications for defining and implementing global security policy, monitoring and controlling weapons proliferation, and initiating acts of counterterrorism. Examines the impact and linkage of terrorism and security on economic development, human rights in counterterrorism, and counterintelligence activities.

**GST 6327 Conflict and Postconflict Development**
Focuses on peace planning and conflict prevention and the vital role that local and international NGOs and public/private partnerships are playing in slowly bringing conflict communities together. Presents case studies on reconciliation and confidence-building measures in societies and countries engaged in long-term conflict and how entities such as the media can hamper or facilitate resolution.

**GST 6340. Poverty and Wealth. 4 Hours.**
Examines models of economic growth and the underlying theories of development, which shape efforts in both developed and developing countries. Introduces the use of economic indicators and measurements of development with reference to situations that have led to economic crises and subsequent responses by governments and institutions. Examines the predominant policy responses of rich and poor countries to the challenges of development, including issues of international assistance and recent trends in poverty reduction and participatory development.

**GST 6350. Global Economics of Food and Agriculture. 4 Hours.**
Designed to provide students with a broad-based understanding of the global food system, while assessing its performance in terms of satisfying world food needs. Examines international dimensions of food system performance, including global trade and international aid; supply and demand trends and their implications for global food security; food and agricultural trade policies; ethics and safety regulations; and specific national food systems. Also examines specific commodity chains and their impact on economic development.

**GST 6610. Sustainable Development. 4 Hours.**
Examines the basic tools of policy analysis in the area of sustainable development. Introduces various techniques used by states, NGOs, and private corporations trying to create viable policy. These may
include game theory, cost-benefit analysis, and critical mass models. Utilizes global case studies to analyze current policy and consider political viability of development programs. At the conclusion of the course, students are required to produce policy recommendations and a policy memo.

**GST 6700. Global Health Perspectives, Politics, and Experiences in International Development. 4 Hours.**

Examines the linkages between health and development that can only be understood within the broader context of sociopolitical and economic factors. Begins with the recognition that poverty plays a central role in many preventable diseases. With the development of nations have come improvements in health. In the landscape of globalization and international development, there has emerged a vast international health regime. Focuses on these linkages in the context of this international political economy of health. Examines key aspects including the concepts and architecture of global health, the global burden and epidemiology of disease, health and development of nations, and political-economic determinants of health and development. Uses a variety of analytical perspectives including political, legal, economic, and epidemiological.

**Homeland Security**

http://catalog.northeastern.edu/course-descriptions/hls/

https://www.northeastern.edu/graduate/program/master-of-arts-in-homeland-security-boston-219/

**HLS 6010. The Unconventional Threat to Homeland Security. 3 Hours.**

Introduces the operational and organizational dynamics of terrorism. Considers those who act as individuals, in small groups, or in large organizations and indigenous actors, as well as those who come to the United States to raise money, recruit, or commit their acts of violence. In every instance, the focus is on violent clandestine activity that, whatever its motivation, has a political purpose or effect. Addresses such specific topics as suicide terrorism, the role of the media, innovation and technology acquisition, the decline of terrorism, and ways of measuring the effect of counterterrorism policies and strategies. The course also looks briefly at sabotage.

**HLS 6020. Technology for Homeland Security. 3 Hours.**

Offers individuals involved in homeland security a broad overview of homeland security technology, information systems, inspection and surveillance technology, communication, knowledge management, and information security. Government agencies in today’s information age are more dependent than ever on technology and information sharing. Focuses on technology as a tool to support homeland security personnel regardless of functional specialty. The methodology used in the course frames technology in terms of its contribution to deterrence, preemption, prevention, protection, and response after an attack.

**HLS 6030. Intelligence for Homeland Security. 3 Hours.**

Examines key questions and issues facing the U.S. intelligence community and its role in homeland security. The September 11, 2001, terrorist attacks on the World Trade Center and Pentagon and the ensuing war on terror have focused the nation’s attention on homeland security. Addresses policy, organizational, and substantive issues regarding homeland intelligence support. Course reference materials provide an overview of diverse intelligence disciplines and how the intelligence community operates. Emphasizes issues affecting policy, oversight, and intelligence support to homeland security.
and national decision making. Covers the 2004 Intelligence Reform and Prevention of Terrorism Act and focuses on homeland intelligence support issues at the state/local/tribal levels.

HLS 6035. Advanced Intelligence Applications for Homeland Security. 4 Hours.
Builds upon the analytical techniques discussed in HLS 6030 and develops actionable intelligence products. Offers students an opportunity to obtain an understanding of how intelligence is gathered and operationalized to support standing requirements and to support specific operations. One of the key roles of intelligence, especially in periods of active war and counterterrorism operations, is the nature, strengths, and weaknesses of intelligence intended to support operations in the field. This course describes how operational requirements are derived, transmitted to, and responded to by intelligence elements and how operational intelligence is collected, analyzed, and then used via practical, real-world situations. Open to U.S. citizens who hold a clearance of secret or higher.

HLS 6040. Critical Infrastructure: Vulnerability Analysis and Protection. 3 Hours.
Focuses largely on protecting the most fundamental critical infrastructures, one of the cornerstones of homeland security. Develops a network theory of vulnerability analysis and risk assessment called “model-based vulnerability analysis,” which is used to extract the critical nodes from each sector, model the nodes’ vulnerabilities by representing them in the form of a fault tree, and then applying fault and financial risk-reduction techniques to derive the optimal strategy for protection of each sector. At the completion of the course, students should be able to apply the model-based vulnerability technique to any critical infrastructure within their multijurisdictional region, derive optimal strategies, and draft policies for prevention of future terrorist attacks.

HLS 6070. Emergency Management and Geographic Information Systems. 3 Hours.
Explores how emergency management activities can best utilize geographic information technologies (GIT) to solve real-world issues in emergency management. This includes planning and response for both natural disasters and man-made events (accidental and terror-related incidents). Through the use of a variety of tools and analytical techniques, demonstrates and explores the nexus between emergency management and GIT. Exposes students to an understanding and appreciation for that relationship as well as the tools and skills for appropriate utilization of them.

HLS 6080. Continuity of Operations and Planning. 3 Hours.
Seeks to enable students to develop and implement continuity of operations (COOP) plans. COOP is a federal initiative, required by presidential directive, to ensure that executive branch departments and agencies are able to continue to perform their essential function under a broad range of circumstances. Today’s changing threat environment and recent emergencies have increased the need for COOP capabilities and plans. Topics include what COOP is and why it is important; how COOP differs from continuity of government (COG); the roles and responsibilities of key players in COOP planning; and family support measures to take in case of COOP implementation.

HLS 6090. Organization and Structural Continuity Planning. 3 Hours.
Covers the importance of protecting critical infrastructure and key resources (CIKR) for continuity planning. Identifies the relevant authorities and roles for CIKR protection efforts and describes the National Infrastructure Protection Plan unifying structure for the integration of CIKR protection efforts, including the sector security partnership model, the risk-management framework, and the information-sharing process. Offers students an opportunity to summarize critical infrastructure responsibilities;
identify the range of critical infrastructure protection government and private-sector partners at the state, local, tribal, territorial, regional, and federal levels; describe processes for effective information sharing with critical infrastructure partners; and identify various methods for assessing and validating information as well as planning for continuity in the event of an emergency.

**HLS 6100. Maritime and Port Security 1. 4 Hours.**
Focuses on the elements of U.S. maritime and port security. With over 95 percent of the trade essential to U.S. economic well-being passing through hundreds of U.S. ports, the protection of port and waterways security is critical to homeland security. Examines U.S. and international policies, laws, and agreements governing maritime security, such as the Maritime Transportation Security Act and the International Ship and Port Security Code. Investigates the organizations responsible for maritime and port security in the United States as well as the potential U.S. and global impact of maritime security failures. Offers students an opportunity to explore the response and planning mechanisms for port security as well as irregular and transnational maritime security issues and their relation to the U.S. maritime transportation system.

**HLS 6150. Essentials of Emergency Management. 3 Hours.**
Examines the hazards and phases in emergency management and planning. Includes all levels of public and private sector involvement in discussing the definition of emergencies and disasters, both natural and man-made, and the issues involved with managing situations. Examines frameworks such as the National Preparedness System; the National Incident Management System; and others for organizing, responding, and mitigating crises from an all-hazards, all-threats perspective, including both U.S. and international concerns. Offers students an opportunity to learn a comprehensive understanding of the U.S. emergency management system; how communities mitigate against, respond to, and recover from all disaster events; as well as the U.S. involvement for international disaster response contingencies.

**HLS 6155. Critical Infrastructure, Security, and Emergency Management. 3 Hours.**
Examines real-world critical infrastructure protection and emergency response to analyze and assess the essential points of protection and prevention combined with emergency response mechanisms for natural and man-made crises. Examines policy, programs, and management of critical infrastructure risk and protection in the context of emergency management and planning for the varying levels of public and private sector involvement. Uses the 16 Critical Infrastructure Sectors as a basis of examining the collaborative responses and complex interactions at all levels of government for today’s emergency management concerns. Uses frameworks such as the National Preparedness System, the National Incident Management System, and others to analyze emergency management processes and examples of historical critical infrastructure threats, failures, and incidents.

**Human Services**

http://catalog.northeastern.edu/course-descriptions/husv/

https://cssh.northeastern.edu/humanservices/

**HUSV 3700. Research Methods for Human Services. 4 Hours.**
Offers an introduction to social science research that examines the theoretical and ethical foundations of social research methods. Highlights foundation knowledge and skills in hypothesis testing, research design, sampling strategies, measurement techniques, and basic data analysis and interpretation. Focuses on program evaluation to provide an opportunity for students to link social science research methods to direct human service practice.
International Affairs

http://catalog.northeastern.edu/course-descriptions/intl/

https://cssh.northeastern.edu/internationalaffairs/

INTL 2240. Global Population and Development. 4 Hours.
Examines the reasons for global population growth and its economic, political, and social challenges. Topics include relation between population and development, environmental consequences, global imbalance in populations, influence of gender on population and development, attempts to control population growth in China and other countries, effects of aging population on economic growth and political life, population and labor force opportunities, population and migration, and the influence of population issues on international relations and global security. In 2012 the world’s population reached 7 billion, with an additional billion being added every 20 years. Emphasizes how issues in national and international affairs are intimately linked with population, focusing on its effects on attempts to improve the quality of life across the globe.

INTL 2718. Research Methods in International Affairs. 4 Hours.
Introduces a range of research methods employed in the study of international affairs. Offers students an opportunity to develop competency in the most commonly used quantitative and qualitative research tools in the social sciences and related humanities. Topics include empirical and normative research traditions, generalizability, historical analyses, hypothesis testing, literature reviews, qualitative and quantitative approaches, research ethics, survey research, units of analysis, and more.

INTL 3200. Cities in a Global Context. 4 Hours.
Examines the roots of the urbanization process, major ways of thinking about it, and the development of world cities and megacities. The twenty-first century will be a century in which urbanism is a central problem and opportunity. Considers the economic, political, cultural, and environmental dimensions of urbanism across the globe. Includes specific case studies from around the world. Encourages students to develop a knowledge of particular cities in order to examine the key themes of the course. INTL 3200, ANTH 3200, and SOCL 3200 are cross-listed.

INTL 3400. International Conflict and Negotiation. 4 Hours.
Offers an interdisciplinary approach to analyzing international conflict and negotiations: how conflicts evolve, are managed, and/or resolved. In dealing with different types of regional and international conflicts, students focus on historical, ethnic, religious, geographic, and political aspects of a variety of conflicts and the consequences these conflicts hold for regional and international actors.

INTL 4500. Latin American Society and Development. 4 Hours.
Explores the processes of social, economic, and cultural change in Latin America. While concentrating on the present, traces class formation, agrarian structures, ethnic identity, ceremonial organization, gender roles, and political conflict since the colonial era in a range of countries. Emphasizes the relationship of communities and national political and economic systems. May emphasize Central America and Mexico or countries in South America through case studies. ANTH 4500 and INTL 4500 are cross-listed.
Marine Studies

http://catalog.northeastern.edu/course-descriptions/mars/
https://cos.northeastern.edu/mes/

MARS 3310. Water Resources Policy and Management. 4 Hours.
Explores the ways in which water has affected our bodies, our planet, our history, our culture, and the danger posed by increasing demand, waste, and pollution on our limited supply of usable fresh water. Considers water through scientific, historical, and cultural viewpoints. Surveys contemporary water problems in all their dimensions-political, economic, and technological.

MARS 3325. Coastal Zone Management. 4 Hours.
Focuses on outstanding issues in coastal environment affairs. Discusses scientific, legal, economic, and technical aspects of coastal issues and integrates them into problem-solving exercises.

Physics

http://catalog.northeastern.edu/course-descriptions/phys/
https://cos.northeastern.edu/physics/

PHYS 1132. Energy, Environment, and Society. 4 Hours.
Seeks to provide nonscience students with a practical knowledge of our present use of the Earth’s energy resources and the environmental consequences. Topics include fossil fuels for transportation and electrical power, global warming, nuclear energy, solar energy, wind power, biomass, electric and hybrid vehicles, and air pollution. No previous knowledge of physics is assumed; nevertheless, because of the nature of the subject, a significant part of the course includes simple quantitative reasoning.

Political Science

http://catalog.northeastern.edu/course-descriptions/pols/
https://cssh.northeastern.edu/polisci/

POLS 2345. Urban Policies and Politics. 4 Hours.
Analyzes the political, administrative, economic, and social dynamics of urban areas. Highlights the diversity of political institutions and practices in American cities. Introduces key policy areas at the city level such as land use, economic development, and education.

POLS 2350. State and Local Politics. 4 Hours.
Examines the political and administrative context of the state and local government in the United States; surveys the structure, function, and politics of states and localities within the context of the U.S. federal system; and highlights the diversity of political institutions and practices at the state and local levels.

POLS 2357. Growth and Decline of Cities and Suburbs. 4 Hours.
Introduces students to the field of urban studies. Focuses on these central issues: how cities and suburbs evolve, what makes a city or suburb a good place to live, and how cities and suburbs are (or are not) planned. Students review the ways in which urban scholars and practitioners study cities and suburbs,
their research methodologies, definition of issues, and division of labor among different disciplines. Students explore the roles of individuals, communities, the private sector, and government in planning and shaping the city.

**POLS 2390. Science, Technology, and Public Policy. 4 Hours.**
Considers the role of science and technology in the policymaking process, not only as a tool but also as a subject of policymaking. Cases include government involvement in innovation and economic growth, the role of the military in the development of science and technology, the governance and regulation of the effects of scientific and technological progress, public funding of science and technology, and ethical aspects of science and technology, including the emerging focus on anticipatory and participatory governance.

**POLS 2395. Environmental Politics and Policy. 4 Hours.**
Examines the political forces, governmental institutions, socioeconomic factors, and global trends that shape environmental policy at national and subnational levels in the United States. A spectrum of different environmental issues is discussed, with some comparison of policy activity in the U.S., other nations, and at the global level.

**POLS 3307. Public Policy and Administration. 4 Hours.**
Analyzes the structure of and dynamics inherent in public policymaking and public administration in the United States. Introduces such concepts as problem definition, agenda development, policy formation, program implementation, and policy evaluation. Covers key issues in public administration including budgeting, personnel, and organizational design.

**POLS 3407. International Organizations. 4 Hours.**
Explores the powers, functions, and effectiveness of international institutions in the context of the growing interdependence of states. Examines international organizations such as the United Nations and European Union in their roles as part of international regimes that address issues such as international security, the international political economy, and human rights.

**POLS 3408. International Security. 4 Hours.**
Examines pressing problems in international security that are on the agenda of nation-states and international and nongovernment organizations. Examples include armed violence, terrorism, organized crime, nuclear proliferation, poverty, infectious diseases, energy security, and environmental degradation. Responses are typically sought through international cooperation and the establishment of international norms that apply to complex problems reaching beyond the borders of any one state.

**POLS 3420. U.S. National Security Policy. 4 Hours.**
Analyzes U.S. national security policy, with an emphasis on traditional and nontraditional threats, including threats from state and nonstate actors. Studies the national security policy process with special attention to developing countermeasures as well as resilience.

**POLS 3423. Terrorism and Counterterrorism. 4 Hours.**
Examines some of the core debates over terrorism and counterterrorism. Topics include what constitutes terrorism, why people become terrorists, which targets they attack, whether nuclear terrorism is a serious threat, the extent to which terrorism helps the perpetrators, and their motives. From there, the course introduces the student to viable counterterrorism strategies. Permission of instructor required for students who do not meet prerequisite.
POLS 3487. Politics of Developing Nations. 4 Hours.
Examines the political, governmental, social, economic, cultural, environmental, and geopolitical dimensions of change in nations regarded as “developing” by international standards. Covers a broad spectrum of types of nations including those in Eastern and Central Europe but pays particular attention to those in Asia, Africa, and Central and South America.

POLS 7333. Science, Technology, and Public Policy. 4 Hours.
Discusses the impacts of breakthroughs in science and technology on politics and public policy making—and how politics in turn influences scientific research and technological development. Examines differences between scientific and democratic values, competing definitions of rationality, the nature of problems, policy-making processes, questions of intellectual property rights, and debates over risk assessment, including the “precautionary principle.” Focuses primarily on the United States but with comparisons to the European Union and other areas of the world. Anchors discussion in such areas as (for example) biotechnology, nanotechnology, alternative energy sources, and artificial intelligence.

POLS 7336. Social Capital and Resilience. 4 Hours.
Examines the role of social capital as in trust, governance, and economics. Focuses on networks and connections in disasters and resilience around the world. POLS 7336 and PPUA 7336 are cross-listed.

POLS 7341. Security and Resilience Policy. 3 Hours.
Examines the post-9/11 evolution of security and the new emphasis on bolstering societal, infrastructure, system, and network resilience. Emphasizes the complex organizational; jurisdictional (international, federal, state, and local); private-sector; and civil-society issues associated with managing the risk of terrorism, cyber-attacks, and naturally occurring disasters. Topics include policy development and implementation of critical infrastructure protection, cybersecurity, supply chain security, disaster management, and community resilience. Requires concurrent registration in POLS 7342 for students in the College of Engineering and students in the MS program in security and resilience.

POLS 7346. Resilient Cities. 4 Hours.
Examines the characteristics of resilient cities, especially those located in coastal regions. Investigates the capacity of cities to respond to major disruptions to their social and ecological systems. Includes extensive use of case studies, such as the 2004 Indian Ocean tsunami and Hurricane Katrina in 2005, as well as readings on cities and social systems. Offers students an opportunity to analyze an urban area and provide recommendations for improving its resilience. POLS 7346 and PPUA 7346 are cross-listed.

POLS 7369. International Security. 4 Hours.
Examines key problems in international security that are faced by nation-states and international and nongovernment organizations. Examples include armed violence, terrorism, organized crime, nuclear proliferation, poverty, and energy security. Explores responses that include international cooperation and the establishment of international norms. Analyzes related literature and theoretical perspectives.

POLS 7441. Cyberconflict. 4 Hours.
Examines the literature, policy reports, and important news stories about the domain of cybersecurity and conflict. Analyzes contending perspectives on the role and impact of cybersecurity. Utilizes social science theories and methods to explore this method of conflict.
POLS 7704. Critical Infrastructure Resilience. 4 Hours.
Explores the growing vulnerability of our human-made built environment to a range of risks. Using the new paradigm centered on the concept of resilience, examines how best to safeguard the critical foundations that provide transport, communications, water, energy, and other essential functions in the face of disasters, growing urbanization, climate change, and globalization. Identifies solutions that are scientifically credible, informed by data and sound engineering principles, while concurrently grounded in an understanding of social and policy imperatives. Offers students an opportunity to apply the skills and knowledge acquired in the course to a real-life example through a group project.

Public Policy and Urban Affairs
http://catalog.northeastern.edu/course-descriptions/ppua/
https://cssh.northeastern.edu/policyschool/

PPUA 5262. Big Data for Cities. 4 Hours.
Investigates the city and its spatial, social, and economic dynamics through the lens of data and visual analytics. Utilizes large public datasets to develop knowledge about visual methods for analyzing data and communicating results. Offers students an opportunity to develop a critical understanding of data structures, collection methodologies, and their inherent biases.

PPUA 5263. Geographic Information Systems for Urban and Regional Policy. 4 Hours.
Studies basic skills in spatial analytic methods. Introduces students to some of the urban social scientific and policy questions that have been answered with these methods. Covers introductory concepts and tools in geographic information systems (GIS). Offers students an opportunity to obtain the skills to develop and write an original policy-oriented spatial research project with an urban social science focus.

PPUA 5264. Energy Transitions and Climate Resilience: Technology, Policy, and Social Change. 4 Hours.
Explores the renewable energy transition with an emphasis on social innovations in energy systems, climate resilience, and the interconnections among technology, policy, and social change. The transition away from fossil fuels toward more efficient, renewable-based energy systems includes much more than a technological substitution; this transition also involves social, institutional, and cultural change in how individuals, households, communities, and organizations relate to and use energy. The emerging concept of energy democracy provides an innovative lens to explore the transformative potential of the renewable energy transition. Explores tensions associated with systemic vs. incremental change, centralized vs. decentralized systems, and infrastructural lock-in vs. flexibility through semester-long team projects in which students contribute to existing, ongoing, local energy transition initiatives.

PPUA 5268. International Environmental Policy. 4 Hours.
Explores key environmental challenges from an international perspective. Provides a history of international environmental politics, as well as discussion of contemporary issues. Presents key paradigms for understanding environmental challenges, and aims to equip students with the analytical tools to look critically at important debates, understand the role of different actors, and assess policy options from multiple perspectives. Focus areas include natural resource management, multi-stakeholder negotiations, and climate change. Themes addressed throughout the course include the role of science in
environmental policy, tensions between environment and development in international environmental politics, and the scale and complexity of international environmental governance.

PPUA 5270. Food Systems and Public Policy. 4 Hours.
Explores the public policy dimensions of the contemporary food system. Utilizes scholarly readings and case studies to assess the role of governing institutions and political actors in shaping the food supply; the effects of energy, transportation, and urban policies on food access; the ecological dimensions of food production; impacts of international trade regimes on global food trade; and the potential impacts of climate change on food security. Compares the United States and other nations and explores alternatives to the dominant food system. Seeks to engage students in applied policy analysis of specific food system issues.

PPUA 5275. Philanthropy and Civil Society. 4 Hours.
Examines the history of philanthropy in the United States and the contemporary role of private giving in the economy and civil society. A comparison of philanthropic theories and models provides context for examining philanthropy’s impact on individuals, communities, social movements, and policy. Emphasizes the relationship between wealth and power in a democratic society.

PPUA 6201. The 21st-Century City: Urban Opportunities and Challenges in a Global Context. 4 Hours.
Offers multidisciplinary examination of the wonders and challenges of urban life, focusing on current dynamics of urban location and prosperity in the context of a global economy. Examines forces that shaped the evolution of cities and metropolitan regions; assesses a range of policy issues confronting metro areas today and the respective roles played by public and private sectors in addressing those challenges; explores global forces that are transforming cities and regions throughout the world; and addresses key questions of urban well-being, civility, and civic engagement.

PPUA 6204. Urban Development and Politics. 4 Hours.
Analyzes the creation and implementation of urban development policies and programs. Explores subsidies and taxes, housing, commercial and industrial development, and job creation and training projects in terms of their historical, political, economic, and social dimensions.

PPUA 6530. State and Local Public Finance. 4 Hours.
Analyzes the fiscal dimensions of state and local governments in the United States. Examines the types and ranges of tax and nontax revenues available to local and state governments and factors shaping the types of revenue sources utilized. Also assesses local and state government spending trends, use of public funds for economic development and other goals, impacts of federal mandates on local and state budgets, distinctions between operating and capital budgets, and the overall legal and political factors shaping public finance.

PPUA 6551. Nonprofit Organizations and Social Change. 4 Hours.
Offers an overview of fundamental principles and practice in the nonprofit sector as they relate to social change. Topics include systems change and stakeholder identification, design thinking and human-centered design, theory of change and logic models, program design and evaluation, strategic and business planning, organizational structure and capacity building, governance, and communications and social media.
PPUA 6552. The Nonprofit Sector in Civil Society and Public Affairs. 4 Hours.
Examines the challenges facing the nonprofit sector, particularly as it relates to civil society and public policy concerns. Emphasizes current controversies in which the nonprofit sector is involved, such as the impact of changes in government spending and tax policy, the nature and legitimacy of nonprofit advocacy, the role of faith-based organizations in providing public services, accountability and oversight of nonprofit organizations, the growth of social entrepreneurship, and the work of nonprofits in fostering social capital and supporting civic engagement.

PPUA 6554. International NGOs and Transnational Activism. 4 Hours.
Explores the theoretical, practical, and ethical elements of the nonprofit sector, which continues to play a critical role in responding to crisis, social and economic inequality, and propelling the human rights agendas forward in a rapidly evolving geopolitical landscape. Both nationally and abroad, nonprofit organizations are addressing society’s most pressing issues. These organizations are compelled to help meet basic human needs during natural and manmade disasters and fill gaps left by government and industry. However, their involvement isn’t without implications, both on the local and international level. Encourages students to consider the complex and sometimes contradictory work being performed by international nongovernmental organizations with an eye to sound program design and leadership.

PPUA 7230. Housing Policy. 4 Hours.
Examines the economic, social, and legal underpinnings of housing policy in the United States across a variety of topics, including housing finance and production, public and affordable housing, home ownership, and fair housing. Housing is both an essential human need and a critical sector of the U.S. economy. Presents the complicated and evolving roles of all of those involved in housing policy, including federal, state, and local government, and the private and profit sectors. Guest speakers provide real-world insights into current housing policy challenges.

PPUA 7231. Transportation Policy. 4 Hours.
Examines the physical, technological, economic, social, cultural, and political underpinnings of transportation policy in the United States. Topics include intra- and interstate transportation, the comparative economics of different modes of transportation, the impacts of federal and state policies on transportation options, and the long-term effects of those choices on metropolitan development, housing, land use, energy, and the environment. Also involves comparisons with transportation systems in other countries.

PPUA 7233. Contemporary Community Development. 4 Hours.
Explores the political and social dynamics of community development in urban America, with particular focus on the local politics of housing, economic development, jobs, healthcare, access to services, and community safety. Uses Boston and its region as a laboratory to examine the role of grassroots community groups in shaping their neighborhoods, set within the broader institutional contexts that affect their representation and impacts.

PPUA 7234. Land Use and Urban Growth Policy. 4 Hours.
Explores the evolution of land use and urban form in the United States and surveys different types of land-use and urban-growth management tools used by local, regional, and state governments. Examines the environmental, economic, spatial, and social impacts of different patterns of urban growth, including “sprawl” and “smart growth,” and the different philosophies and legal and policy approaches employed to manage those impacts. Also explores how land-use and urban-growth policy interacts with related priorities, including housing, infrastructure, and fiscal policy. Focuses on current and emerging issues and
debates in land-use and urban-growth management, such as New Urbanism, livable communities, and transit-oriented development.

**PPUA 7237. Advanced Spatial Analysis of Urban Systems. 4 Hours.**
Builds on skills covered in **PPUA 5263**. Offers students an opportunity to obtain greater depth in the analysis of urban spatial data focused on several urban systems (including social, built, and natural systems). Focuses on understanding the spatial relationships between various new and large urban datasets relevant to current policy challenges within cities. This is a project-based class.

**PPUA 7239. Problems in Metropolitan Policymaking. 4 Hours.**
Examines the broad challenges that confront metropolitan areas-defined as including the center city, its immediate suburbs, and the broader periphery-including economic development, land use, transportation, housing, and the provision of basic services. Considers the array of tools available to policymakers, including planning, tax policy, pooling of services, and zoning.

**PPUA 7249. Urban Coastal Sustainability. 4 Hours.**
Focuses on the challenges facing coastal cities and the ecosystems on which they depend by exploring both threats such as climate change as well as adaptation measures that promote resilience. Aimed at students interested in the interface of science and public policy and those who wish to gain a deeper understanding of how coupled human-natural ecosystems operate.

**PPUA 7336. Social Capital and Resilience. 4 Hours.**
Examines the role of social capital as in trust, governance, and economics. Focuses on networks and connections in disasters and resilience around the world. **POLS 7336 and PPUA 7336** are cross-listed.

**PPUA 7346. Resilient Cities. 4 Hours.**
Examines the characteristics of resilient cities, especially those located in coastal regions. Investigates the capacity of cities to respond to major disruptions to their social and ecological systems. Includes extensive use of case studies, such as the 2004 Indian Ocean tsunami and Hurricane Katrina in 2005, as well as readings on cities and social systems. Offers students an opportunity to analyze an urban area and provide recommendations for improving its resilience. **POLS 7346 and PPUA 7346** are cross-listed.

*Sociology*

[http://catalog.northeastern.edu/course-descriptions/socl/](http://catalog.northeastern.edu/course-descriptions/socl/)

[https://cssh.northeastern.edu/socant/](https://cssh.northeastern.edu/socant/)

**SOCL 1246. Environment and Society. 4 Hours.**
Examines the social, political, and economic forces behind the global environmental crisis. Topics include such issues as global warming and climate disruption, world resource availability and the global economic crisis, environmental justice and social inequities in the exposure to ecological hazards, science and technology, environmental degradation in the Third World, globalization and unfair trade, state power and the role of the polluter-industrial complex in the United States, the history of the environmental movement, and exemplary environmental policies and programs. This theoretically oriented course also involves practical experience in environmental problem solving.
SOCL 1275. Social Stratification. 4 Hours.
Explores the causes and consequences of the unequal distribution of prestige, power, and wealth in human societies. Topics may include theories of social stratification; varieties of human stratification systems; various dimensions of stratification (race gender, class); and the ideologies used to justify (and criticize) inequalities. While the features of multiple societies are considered, primary emphasis is on the development and contemporary structure of the American class system.

SOCL 2268. Social Movements. 4 Hours.
Introduces the social, cultural, and political dynamics that surround social movements, both historically and in the contemporary world. Emphasizes theory and research on national and transnational social movements, including studies of revolutions and political upheavals, demands for civil and human rights, movements for gender equality, and other instances of movements for social and political change. Emphasizes how structural factors shape social movement emergence and development and how social movements in turn shape the structure of societies.

SOCL 2358. Current Issues in Cities and Suburbs. 4 Hours.
Introduces students to pressing urban issues: urban sprawl, poverty, education, transportation, economic development, and housing, through an intensive analysis of the Boston metropolitan area. The course is cotaught by university faculty and practitioners in government, community, and nonprofit organizations throughout the metropolitan area. Offers students the opportunity to analyze Boston data, go on outings to see development in progress, talk with urban practitioners about what they do, and conduct research on an urban issue of their choice.

SOCL 2450. Class, Power, and Social Change. 4 Hours.
Focuses on theories of social inequality as applied to the exercise of power and large-scale social change. Examines contemporary events in order to understand power structures.

SOCL 3200. Cities in Global Context. 4 Hours.
Examines the roots of the urbanization process, major ways of thinking about it, and the development of world cities and megacities. The twenty-first century will be a century in which urbanism is a central problem and opportunity. Considers the economic, political, cultural, and environmental dimensions of urbanism across the globe. Includes specific case studies from around the world. Encourages students to develop a knowledge of particular cities in order to examine the key themes of the course. INTL 3200, ANTH 3200, and SOCL 3200 are cross-listed.

SOCL 3465. Globalization and the Evolution of Human Societies. 4 Hours.
Examines current issues of globalization from a sociological viewpoint, emphasizing the forces that create ties between societies and the consequences of these ties. Analyzes the structures of human societies, the ways in which they change over long periods of time, and the consequences of changes for people’s actions and beliefs. Stresses the importance of social “environments” in understanding social change and of the process of social adaptation. Uses sociological concepts to analyze current issues of globalization, their origins, and ways of dealing with them.

SOCL 7221. Globalization, Development, and Social Justice. 4 Hours.
Explores the rise of neoliberal globalization and its impact on local and national communities around the world. Examines complex patterns of resistance, including place-based struggles and transnational social movements. Combines theoretical analysis of global capitalism, development, the politics of resistance,
and reformist/radical alternatives with the study of concrete struggles in defense of land, labor and human rights, indigenous cultures and identities, and ecological sustainability.

**SOCL 7230. Political Ecology of Global Capitalism. 4 Hours.**
Analyzes the political economy of international capitalism, really existing state socialism, and the global environment. Includes philosophies of nature; laws of capital accumulation and ecological degradation; technology and the division of labor; combined and uneven development, imperialism, and ecological crises in the Third World; the relationship between economic and ecological crises; environmental policy, democracy, and the state; ecological racism, sexism, and classism; and the crisis of social movements in the United States.

**SOCL 7268. Globalization and the City. 4 Hours.**
Considers the conditions of cities and their residents in the era of globalization. Cities have always been located at the center of regional and global networks of trade, capital, and culture. Even so, urban sociology has tended to treat cities as closed systems, defined more by internal logics than by broader social and economic forces. Since the early 1990s, however, shifts under way in the global economy, information and communications technologies, political movements, and cultural processes have altered the way that scholars (and policy makers, planners, architects, urban residents, etc.) look at cities. Increasingly, the world’s cities are regarded as nodes in global networks; and correspondingly, urban social and spatial processes are being viewed through global lenses.

*Telecommunications*

[http://catalog.northeastern.edu/course-descriptions/tele/](http://catalog.northeastern.edu/course-descriptions/tele/)

[https://www.northeastern.edu/graduate/program/master-of-science-in-telecommunication-networks-5285/](https://www.northeastern.edu/graduate/program/master-of-science-in-telecommunication-networks-5285/)

**TELE 5340. Telecommunications Public Policy and Business Management. 4 Hours.**
Introduces students to business management issues, such as basic accounting, finance, marketing, and operations in the telecommunications field, and also topics such as the time value of money and decision making. Also includes issues of human relations, organizational behavior, and business strategy. Provides an understanding of the regulatory environment of the telecommunications industry. Topics include universal service, service quality tariffs, the Modified Final Judgment and Telecom Act of 1996, market restrictions and segmentation, the current competitive environment in the United States and internationally, interconnection including unbundling, collocation, economic issues, and global trends in market reform.

**TELE 5350. Telecom and Network Infrastructure. 4 Hours.**
Provides in-depth treatment of the wireline and wireless infrastructure of the network supporting all telecommunication, internet, and enterprise applications. Covers the basics of communications—source coding, baseband and broadband modulation and transmission, channel coding, spread-spectrum, multiuser radio communications, radio link analysis, and propagation. Also covers the wireline core network—digital and optical transmission, framing, network synchronization, asynchronous and synchronous multiplexing, cross connects, SONET/SDH, DWDM, OTN, protection switching, and network availability.
*NOTE: This document is a selection of courses, research and organizations, and not a comprehensive list. For more details, please visit Northeastern’s website, or speak to an enrollment counselor.