Master Degree Program in Environmental Sciences

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Background

The Interfaculty Graduate Environmental Sciences Program (IGESP) is a multidisciplinary field of study which leads to the Master of Sciences degree in Environmental Sciences with four possible majors: Environmental Technology, Ecosystem Management, Environmental Health, and Environmental Policy Planning.

Together, these majors ensure adequate coverage of all environmental and sustainable development issues prevailing in Lebanon and the Arab World, in their various ecological, economic and social dimensions.

The program has been designed to cater to the rising demand for environmental scientists in the Middle East region. The specificity of the region's environment is reflected both in the program's academic and educational perspectives.

Founded in the mid-1990s, the IGESP program, recognizing Lebanon's unique diversity – environmental, societal and cultural – also understands that various environmental problems affect the integrity of the country's ecosystems. Accordingly, IGESP adopts a holistic approach to resolving those problems, and offers a course of study designed to address both the most salient environmental issues as well as more specialized topics.

IGESP draws on the resources of various faculties/departments and provides opportunities for study and research in the field of the environment in its totality. While the program caters mostly to physical and natural sciences students, it is offered to students holding a bachelor's degree in any approved discipline of engineering or science. It provides graduates with the necessary tools to assess diversified and multidisciplinary environmental issues. The program focuses on enhancing students' research, analytical, problem-solving and critical-thinking skills by emphasizing the case study approach to learning and solving environmental problems.

Like all programmes at the American University of Beirut, IGESP is registered in the US through the New York State Education Department.

Mission

The mission of the AUB IGESP Program is to contribute to building the environmental capacity in Lebanon and the region through human resources development as well as research and community involvement. The essence of the program lies in its interdisciplinarity. The program is firmly based on a holistic view of the environment that integrates the ecological, technical, health and socioeconomic dimensions. We aim to train creative, flexible and cross-curricular graduates capable of appreciating, building on, and applying cutting-edge knowledge for the management of the environment. Our graduates are empowered with exceptional technical, managerial, critical evaluation, research and reporting skills.

Vision

The IGESP Program aspires to be the leading interdisciplinary program bridging environmental education, research and service through close partnership with academic institutions and civil society actors.

General Information

The degree of Master of Science (MS) in Environmental Sciences is offered with four possible majors:

- Ecosystem Management in the Faculty of Agricultural and Food Sciences (FAFS)
- Environmental Health in the Faculty of Health Sciences (FHS)
- Environmental Technology in the Maroun Semaan Faculty of Engineering and Architecture (MSFEA)
- Environmental Policy Planning in the Faculty of Arts and Sciences (FAS)

The program draws on the resources of various departments of the faculties of Agricultural and Food Sciences (FAFS), Arts and Sciences (FAS), Engineering and Architecture (MSFEA), Health Sciences (FHS) and Medicine (FM), and it provides opportunities for study and research in the general field of environment.

The program provides graduates with the necessary tools for professional practice and/or the pursuit of higher education. It is administered by an interfaculty committee that coordinates with the graduate committees of the faculties concerned.

Criteria for Admission

To be accepted into the program, an applicant must:

- meet general university requirements for admission to graduate study.
- be recommended by the appropriate faculty graduate committee and accepted by the Interfaculty Coordinating Committee of the program.
- Provide at least two letters of recommendation.
- Submit a detailed effective statement of purpose (400-500 words) for each major indicating the purpose for pursing graduate study in the particular field at AUB and specifying the applicant's research interests and/or practical experience in the field. Note: The statement should be oriented to the major.
- have a background that is relevant to the major.

Applicants to the program may be admitted under the following categories:

- graduate - if the average in the last 60 credits or the last two years is greater than 80 (3.2)
- graduate on probation - if the average in the last 60 credits or the last two years is less than 80 (3.2) and greater than 75 (2.7)

Adequate preparation to take any graduate course is decided by the academic advisor and the Interfaculty Graduate Environmental Sciences Program Committee (IGESPC).

Degree Requirements

Requirements for the degree of Master of Science in Environmental Sciences (any major), both thesis and non-thesis options, are tabulated below. The master's degree with thesis option will normally require between 20 and 24 months to be completed. In both options, the student is required to complete 30 credits of which 9 credits are core courses.

Course	Group	Thesis Option Credits	Non-Thesis Option Credits
Core	A	9	9
Electives	B	15	18
Thesis		6	
Project			3
Total number of credits required for graduation			**30**

Core courses, as well as basic and broad electives, are listed below. Other relevant electives not listed below may be accepted on a case-by-case basis. These courses are structured to provide students with a diversified and multidisciplinary background in environmental sciences. Students have to register for the core course offered by their faculty of concentration. Students are also required to select two other supplementary courses from the list of core courses approved by the program. Students may not select two core courses from the same faculty. Students can take other elective courses from other faculties after securing the approval of the advisor. Specific faculty/department requirements are defined under each respective faculty/department.

Group A	Core Courses in Environmental Sciences	Credits
ENSC 630/LDEM 630	Natural Resources Management	3
ENSC 640/ENHL 310	Toxicology and Environmental Health Hazards	3
ENSC 650/PSPA 316	International Environmental Policy	3
One of the following offered courses		
ENSC 600/CIVE 655	Air Pollution and Control	3
CIVE 551	Wastewater Treatment and Laboratory	3
CIVE 552	Waste Management and Treatment	3
CIVE 553	Environmental Biotechnology	3
CIVE 555	Air Quality Management	3
ENSC 620	Water and Wastewater Treatment Technology	3
CIVE 654	Environmental Bioremediation	3

Group B	Examples of Major Electives	Credits
1. Ecosystem Management		
ENSC 600/CIVE 655	Air Pollution and Control	3
CIVE 552	Waste Management and Treatment	3
ENSC 631/LDEM 631	Agricultural Pollution and Control	3
ENSC 633/LDEM 633	Ecological Landscape Design and Planning	3
ENSC 634/LDEM 634	Sustainable Landscape Planning and Management	3
ENSC 635/LDEM 635/ PSPA 3446A	Political Ecology of Water	3
ENSC 622/CIVE 653	Environmental Chemistry and Microbiology	3
ENSC 641/ENHL 312	Occupational Health	3
ENSC 642/ENHL 314	Environmental Management Systems	3
ENSC 652/CIVE 656	Environmental Impact Assessment	3
ENSC 654	Physical and Biological Resources in Terrestrial Ecosystems	3
ENSC 655/AGSC 301	Statistical Methods in Agriculture	3
ECON 333	Energy Economics and Policy	3
ENSC 662/ECON 338	Economics of Natural Resources and the Environment	3
LDEM 300	Directed Study in Ecosystem Management	3
LDEM 301	Urban Greening	3
LDEM 302	Green Infrastructure for Resilient Landscapes and Cities	3
BIOL 362	Advanced Ecology	3
BIOL 363	Population and Community Ecology	3
AGSC 376	Resource and Environmental Economics	3
AGSC 384	Political Economy of Middle East Development	3
CIVE 648	Climate Change and Water Resources	3
CIVE 552	Waste Management and Treatment	3
CIVE 633	Soil and Site Improvement	3
CIVE 654	Environmental Bioremediation	3
CIVE 655	Air Pollution and Control	3

Group B	Examples of Major Electives	Credits
CIVE 659	Environmental and Water Conflict Management	3
URPL 664	Urban Land Use Planning	3
URPL 665	Development and Planning Policies	3

2. Environmental Health	Core courses required of all Environmental Health majors	
ENHL 300	Introduction to Environmental Health	2
EPHD 300	Principles of Epidemiology	3
PBHL 300	Foundations of Public Health	3
Electives		
PBHL 310	Research Design	3
EPHD310	Basic Biostatistics	3
ENSC 600/CIVE 655	Air Pollution and Contro I	3
ENSC 641/ENHL 312	Occupational Health	3
ENSC 642/ENHL 314	Environmental Management Systems	3
ENHL 307	Food Safety	3
ENHL 308	Tutorial	1-3
ENHL 320	Special Topics in Environmental Risk Analysis	3
ENSC 652/CIVE 656	Environmental Impact Assessment	3
ENSC 658/PSPA 343	Environmental Conflict Resolution	3
ENSC 661/BIOL 363	Population and Community Ecology	3
ENSC 662/ECON 338	Economics of Natural Resources and the Environment	3
CIVE 659	Environmental and Water Conflict Management	3

3. Environmental Technology		
CIVE 551	Wastewater Treatment and Laboratory	3
CIVE 552	Waste Management and Treatment	3
CIVE 553	Environmental Biotechnology	3
CIVE 555	Air Quality Management	3
CIVE 602	Experimental Design and Statistical Methods	3
CIVE 650	Water and Sewage Works Design	3
CIVE 651	Processes in Water and Wastewater Treatment	3
CIVE 652	Landfill Engineering Design	3
CIVE 653	Environmental Chemistry and Microbiology	3
CIVE 654	Environmental Bioremediation	3
ENSC 600/CIVE 655	Air Pollution and Control	3
CIVE 656	Environmental Impact Assessment	3
ENSC 651/CIVE 657	Methods of Environmental Sampling and Analysis	3
CIVE 751	Wastewater Reclamation and Reuse	3
CIVE 658	Industrial Waste Management	3
CIVE 659	Environment and Water Conflict Management	3
ENSC 602/CIVE 755	Air Pollution Modeling	3
ENSC 642/ENHL 314	Environmental Management Systems	3

3. Environmental Technology		
ENSC 662/ECON 338	Economics of Natural Resources and the Environment	3

4. Environmental Policy Planning		
PPIA 301	Public Policy and Practice	3
PPIA 304	Development	3
PPIA 305	Economics for Public Affairs	3
PPIA 306	Political Economy	3
PPIA 307	Politics of Policy-Making	3
PPIA 308	Research Methods	3
PPIA 309	Topics in Public Policy	3
PPIA 310	The Politics of Policy-Making	3
PSPA 300	Methodology and Research Design	3
PSPA 312	Public International Law	3
PSPA 314	The UN and International Politics	3
PSPA 324	Government and Politics of Lebanon	3
PSPA 345	Special Topics in Environmental Policy and Politics	3
PSPA 346	Special Topics in Natural Resource Policy and Politics	3
PSPA 351	New Public Management	3
PSPA 352	Foundations of Public Policy	3
PSPA 360	Public Policy Research and Analysis	3
ENSC 659/PSPA 362	Public Policy and Administration	3
PSPA 373	The Ethics of Public Administration	3
AGSC 376	Resource and Environmental Economics	3
AGSC 384	Rural Social Change, Development the Environment	3
ECON 333	Energy Economics and Policy	3
ECON 338	Economics of Natural Resources and the Environment	3
URPL 664	Urban Land Use Planning	3
URPL 665	Development and Planning Policies	2
CIVE 601	GIS and Geospatial Data Modeling	3

A student can take other elective courses from other faculties after securing the approval of her/his advisor.

Graduation Requirements

See General University Academic Information in this catalogue.

Master of Science in Environmental Sciences-Suggested Curriculum

Term I	Fall	Credits
ENSC 640	Toxicology and Environmental Health Hazards	3
Any one of the following offered courses:		
ENSC 600/CIVE 655	Air Pollution and Control	3
CIVE 552	Waste Management and Treatment	3
ENSC 620	Water and Wastewater Treatment Technology	3
CIVE 555	Air Quality Management	3
CIVE 551	Wastewater Treatment and Laboratory	3
CIVE 553	Environmental Biotechnology	3
CIVE 654	Environmental Bioremediation	3
ENSC 69_	Elective	3

Term II	Spring	Credits
ENSC 630	Natural Resources Management	3
ENSC 650	International Environmental Policy	3
Any one of the following offered courses:		
ENSC 600/CIVE 655	Air Pollution and Control	3
CIVE 552	Waste Management and Treatment	3
ENSC 620	Water and Wastewater Treatment Technology	3
CIVE 555	Air Quality Management	3
CIVE 551	Wastewater Treatment and Laboratory	3
CIVE 553	Environmental Biotechnology	3
CIVE 654	Environmental Bioremediation	3
ENSC 69_	Elective	3

Term III	Summer	Credits
ENSC 699	Thesis	3

Term IV	Fall	Credits
ENSC 699	Thesis	3
ENSC 69_	Elective	3

Term V	Spring	Credits
ENSC 699	Thesis	3
ENSC 69_	Elective	3

Term VI	Summer
ENSC 699	Thesis (continued)

Non-Thesis Option		
Term I	**Fall**	**Credits**
ENSC 640	Toxicology and Environmental Health Hazards	3
ENSC 69_	Elective	3
Any one of the following offered courses:		
ENSC 600/CIVE 655	Air Pollution and Control	3
CIVE 552	Waste Management and Treatment	3
ENSC 620	Water and Wastewater Treatment Technology	3
CIVE 555	Air Quality Management	3
CIVE 551	Wastewater Treatment and Laboratory	3
CIVE 553	Environmental Biotechnology	3
CIVE 654	Environmental Bioremediation	3

Term II	**Spring**	**Credits**
ENSC 630	Natural Resources Management	3
ENSC 650	International Environmental Policy	3
Any one of the following offered courses:		
ENSC 600/CIVE 655	Air Pollution and Control	3
CIVE 552	Waste Management and Treatment	3
ENSC 620	Water and Wastewater Treatment Technology	3
CIVE 555	Air Quality Management	3
CIVE 551	Wastewater Treatment and Laboratory	3
CIVE 553	Environmental Biotechnology	3
CIVE 654	Environmental Bioremediation	3
ENSC 69_	Elective 3	3

Term III	**Summer**	**Credits**
ENSC 697	Project	3
ENSC 69_	Elective	3

Term IV	**Fall**	**Credits**
ENSC 69_	Elective	3

Term V	**Spring**	**Credits**
ENSC 697	Project	3
Total		**30**

Course Descriptions

CIVE 551 Wastewater Treatment and Laboratory 3 cr.
A course that examines the quality and principles of municipal wastewater treatment processes and methods of testing for physical, chemical and biological parameters. *Prerequisite: CIVE 252 or equivalent, or consent of instructor.*

CIVE 552 Waste Management and Treatment 3 cr.
A course on engineering principles, practices and techniques for the management of solid wastes: sources, composition, properties, impacts, generation, storage, collection and transport, processing, resource recovery, and disposal.

CIVE 553 Environmental Biotechnology 3 cr.
A course that examines current and emerging environmental biotechnologies used for environmental quality evaluation, monitoring and remediation of contaminated environments, and provides students with working knowledge of the science that underpins them. *Prerequisite: CIVE 252 or equivalent, or consent of instructor.*

CIVE 555 Air Quality Management 3 cr.
A course on the principles, practices and techniques for the management of air pollution: Types, sources, properties, impacts, standards, control technologies, atmospheric dispersion, emissions and indoor air quality.

CIVE 601 GIS and Geospatial Data Modeling 3 cr.
A course that examines the concepts and principles of Geographic Information Systems (GIS). It provides coverage of state-of-the-art GIS methods and tools: spatial and terrain analysis, geostatistical analysis, time series analysis and development of GIS integrated models.

CIVE 602 Experimental Design and Statistical Methods 3 cr.
A course that covers the main steps required to efficiently plan, conduct, analyze and interpret the results from experiment and observational studies. The course focuses on statistical inference and modeling. Topics covered include ANOVA, t-tests, regression models and nonparametric tests. The course involves working within a statistical modeling environment.

ENSC 620 Water and Wastewater Treatment Technology 3 cr.
A course that examines the quality and principles of municipal and industrial water treatment processes and methods of testing for physical, chemical and biological parameters. *Prerequisite: CIVE 251 or equivalent, or consent of instructor.*

CIVE 633 Soil and Site Improvement 3 cr.
A course that covers compaction, admixture stabilization, foundation soil treatment, reinforced soil and composite materials, and material sites reclamation.

CIVE 648 Climate Change and Water Resources 3 cr.
An introductory course on global climate change and its potential impacts on water resources and related sectors. It explores drivers of climate change, greenhouse gases emissions and mitigation efforts, and adaptation options with emphasis on Integrated Water Resources Management.

CIVE 650 Water and Sewage Works Design 3 cr.
A course that examines the design of water and wastewater schemes, including design reports and a literature search on the development of conventional treatment processes. *Prerequisites: CIVE 550 and CIVE 551, or consent of instructor.*

CIVE 651 Processes in Water and Wastewater Treatment 3 cr.
A course on sedimentation, filterability, permeability and fluidization, ion exchange, aeration, flotation, membrane filtration, and aerobic digestion. Experimental applications of processes. *Prerequisite: CIVE 251, CIVE 252 or equivalent; or consent of instructor.*

CIVE 652 Landfill Engineering Design 3 cr.
A course on solid waste disposal with emphasis on design development of landfill elements: site selection and characterization, gas extraction and management, leachate collection and management, liners, covers, closure and post-closure monitoring. *Prerequisite: CIVE 552.*

CIVE 653 Environmental Chemistry and Microbiology 3 cr.
A course that deals with organic, inorganic and physical chemistry; chemical equilibrium; reaction kinetics; acidity, alkalinity; composition, morphology and classification of microorganisms; energy, metabolism and synthesis; growth, decay and kinetics; and biological water quality indicators. *Prerequisite: CIVE 251, CIVE 252 or equivalent; or consent of instructor.*

CIVE 654 Environmental Bioremediation 3 cr.
A course that discusses the application of biological treatment for the remediation of contaminated environments, and highlights current engineering methods/design used to enhance biodegradation.

CIVE 655/ ENSC 600 Air Pollution and Control 3 cr.
A course that examines processes and design equipment for the control of particulates and gaseous emissions. *Prerequisite: Consent of instructor.*

CIVE 656 Environmental Impact Assessment 3 cr.
A course on procedures of assessing/preparing/reviewing/presenting environmental impacts of developmental projects/facilities: industrial facilities, waste management/disposal, wastewater treatment, transportation, dams and reservoirs, irrigation/drainage schemes, coastal zone developments, natural resource management, and so on. *Prerequisite: E4 status or consent of instructor.*

CIVE 657/ ENSC 651 Methods of Environmental Sampling and Analysis 3 cr.
A course on sampling techniques and instrumental methods in environmental sciences; determination of pollutants in water, air and soil; analytical techniques; adaptation of procedures to specific matrices; case studies. *Prerequisite: CIVE 251, CIVE 252, or equivalent; or consent of instructor.*

CIVE 658 Industrial Waste Management 3 cr.
A course on engineering principles, practices and techniques for the management of industrial hazardous wastes: sources, generation, properties. Impacts and auditing of industrial facilities. Basic treatment processes and disposal methods. Site remediation. *Prerequisite: Consent of instructor.*

CIVE 659 Environmental and Water Conflict Management 3 cr.
A course on the development of case studies in environmental and water conflict management taught under a framework of role-play of opponents perspective and decision making thereof.

CIVE 751 Wastewater Reclamation and Reuse 3 cr.
A course that examines environmental issues in water reuse, risk assessment, water reclamation technologies, storage of reclaimed water, usage of reclaimed water, and planning of wastewater reclamation and reuse. *Prerequisite: CIVE 551.*

CIVE 755/ ENSC 602 Air Pollution Modeling 3 cr.
A course that deals with mathematical models, air pollution meteorology, plume rise, dispersion and atmospheric chemistry, meteorological models; as well as Gaussian, statistical and other special application models. *Prerequisite: CIVE 555 or consent of instructor.*

LDEM 300 Graduate Tutorial 1-3 cr.
Directed Study in Ecosystem Management.

LDEM 301 Urban Greening 3 cr.
Green infrastructure is an ecologically based system, naturally occurring or engineered, across urban and rural contexts, that is multi-functional and delivers essential cultural, social, environmental, ecological and economic benefits. It requires a holistic and systems approach to improving ecological function while providing vital ecosystem services for human populations. This course introduces students to the concepts, theories and applications of design, planning and policy of green infrastructure in conjunction with open space planning and design. A particular focus is the relationship between green infrastructure and climate change adaptation of landscapes and cities. A case study approach is utilized to study green infrastructure across multiple scales, disciplines and applications in the Middle East and North Africa (MENA) region. Green infrastructure is inherently multi-disciplinary and intersects with landscape architecture; urban design and planning; architecture; environmental engineering; public health; urban policy; and environmental policy.

LDEM 302 Green Infrastructure for Resilient Landscapes and Cities 3 cr.
The course introduces students to the concepts, theories and applications of design, planning and policy of green infrastructure with a focus on the delivery of ecosystem benefits. A particular focus is the relationship between green infrastructure and climate change adaptation of landscapes and cities. A case study approach is utilized to study green infrastructure across multiple scales, disciplines and applications in the Middle East and North Africa (MENA) Region.

ENSC 630/ LDEM 630 **Natural Resources Management** **3 cr.**

This course introduces students to key concepts in ecosystem-based natural resources management (NRM) and to the management of specific terrestrial resources: soils, water, land and biodiversity with examples drawn from drylands and developing nations. A landscape lens is adopted to examine territory-scale resource management options, such as farming, ecotourism, forestry and rangelands. The course also addresses the physical, socioeconomic, cultural, political and geographic specificity of NRM by reviewing the status of Arab Natural Resources in a changing environment.

ENSC 631/ LDEM 631 **Agricultural Pollution and Control** **3 cr.**

This course introduces students to the fate of agrochemicals in the environment and their effect on terrestrial and aquatic systems. Contamination, monitoring residues, methodologies and risk assessment models are studied and researched.

ENSC 633/ LDEM 633 **Ecological Landscape Design and Planning** **3 cr.**

This course is an introduction to the theory and methodology of ecological landscape design and planning; it aims to introduce the holistic approach of landscape ecology and its application in the sustainable management of natural and cultural landscape and ecosystems.

ENSC 634/ LDEM 634 **Sustainable Landscape Planning and Management** **3 cr.**

This course is an introduction to the theory and methodology of sustainable landscape planning, which aims at introducing a holistic approach of sustainable planning on the national level of management, including the legal framework, relevant sector policies and prevailing practices.

ENSC 635/ LDEM 635/ PSPA346A **Political Ecology of Water** **3 cr.**

This course provides an approach to understanding water issues, bringing together political economy and hydro-geography. The course objective is to introduce students to the modes of use and management of water resources, analyzing the causes of water injustice, revealing power relations and environmental hidden costs. The course is planned to emphasize the situation of water politics in the Arab region.

ENHL 300 **Introduction to Environmental Health** **2 cr.**

A course that introduces students to the physical life support system and interactions with the socioeconomic context. Emphasis is placed on assessing, preventing, and controlling environmental hazards affecting human health and ecological wellbeing. The role of local and global regulatory systems in impacting change and sustaining a healthy environment is highlighted. Enabling communities through this process of sustainable development is critically emphasized.

EPHD 300 Principles of Epidemiology 3 cr.
A course in principles, concepts and applications of epidemiology in the public health field. The course consists of lectures, assigned readings and complementary practical sessions that provide students with basic epidemiological knowledge and tools relevant to public health practice. Students are given the opportunity to acquire an understanding of the vocabulary of epidemiology and methods of epidemiological research, investigation and control. Topics covered include rubrics of epidemiology, morbidity and mortality measures, sources of epidemiological data, outbreak investigation, epidemiological study designs, causal inference and causation in epidemiology. This course also covers an overview of the major biological agents and the ecology and dynamics of communicable diseases.

EPHD 310 Basic Biostatistics 3 cr.
An introductory Biostatistics course that covers basic concepts in statistical methods. The course demonstrates methods of exploring, organizing and presenting data. The course presents the foundation of statistical inference from estimation to confidence interval and testing of hypotheses. Applications include comparing population means or proportions via data obtained from paired or independent samples, one-way ANOVA. Also, it introduces simple linear regression, correlations, logistic regression and nonparametric methods for data analysis.

PBHL 300 Foundations of Public Health 3 cr.
The course introduces students to the foundations, disciplines, values and ethics of the field of public health. The course also develops students' analytical thinking through the discussion of relevant published articles, particularly highlighting the interdisciplinary nature of the public health issue and the role of each of its five core disciplines (Environmental Health Sciences, Health Policy and Management/Health Administration, Epidemiology, Biostatistics and Health Promotion). This course is required for all MS students of the Faculty of Health Sciences. *Corequisite: EPHD 300.*

PBHL 310 Research Design 3 cr.
This course discusses principles of research design and the methods used in both quantitative and qualitative social research methodologies in the public health field. Topics include formulation of research questions, literature review, sampling issues, methods of data collection and analysis. Practical ethical issues in research are also discussed.

ENHL 307 Food Safety and Health 3 cr.
The course will focus on the safety and management of processed food products. It will address the advantages and limitations of food processing techniques and, in specific, the application of food additives. Areas covered will relate mainly to food safety and quality control, health impacts, types and limitations of food processing methods, use of food additives, exposure estimation, toxicological implications, risks and benefits governing use and quality control measures and applications both at the national and international levels.

ENHL 308 Tutorial 3 cr.
This course is a tutorial on Special Environmental Health projects of interest to the students. A written report is required.

ENSC 640/ ENHL 310 Toxicology and Environmental Health Hazards 3 cr.

The course presents toxicology in three sections. In the first section, the fundamental principles and essentials of toxicology are introduced, particularly dose-response, toxicokinetics, and cellular mechanisms of action. In the second section, the course discusses toxicity of main organ systems. Classic toxicants that adversely affect health, emerging hazardous human exposures, and special topics, are discussed in the last section of the course. The course includes lecture style presentations, collective case-studies activities, and student led discussions. Topics of local and regional relevance are also introduced through hosting guest speakers.

ENSC 641/ ENHL 312 Occupational Health 3 cr.

This course overviews the general principles of occupational health, relating work, the work environment, and workers' health and wellbeing to general principles of social equity and justice. The course surveys research on the social, economic, political, environmental, and health elements of a workplace using multidisciplinary approaches. Students who join the course are able to identify occupational hazards and work-related injuries and illnesses in workplaces and propose monitoring, management and prevention strategies to lessen their impact on workers. With its emphasis on social justice, the course discusses the factors that make some workers' groups more vulnerable than others. Its unique approach emphasizes global perspectives and popular imaginations of workers through academic publications, newspaper journalism, cinema, lectures and class discussions. This course is designed for students of multiple educational and training backgrounds and does not require prerequisite knowledge.

ENSC 642/ ENHL 314 Environmental Management Systems 3 cr.

The implementation of an Environmental Management System (EMS) integrates the precautionary and polluter pays principles into firms' operations and demonstrates commitment to sustainable development. This course provides an overview of the most common international standards for environmental management systems, primarily the International Standards Organization (ISO) harmonized management systems, and its implications for different organizations. It provides students with the skills to formulate and evaluate such management systems. Though the first part of the course is mainly lecture based, student participation in the form of questions and discussion is always welcomed and encouraged. Critical thinking will be promoted throughout the course. Students will be expected to formulate an EMS for an organization and prepare a technical report to communicate project findings to their colleagues through verbal presentation. Emphasis is placed on solving environmental problems using an integrated management approach in order to achieve an optimized environmental performance.

ENHL 320 Special Topics in Environmental Health 3 cr.

A course that covers selected topics such as risk analysis, environmental ethics and justice, or environmental policy and allows focused examination of special topics of interest to trainees in Environmental Health.

PPIA 301 Public Policy and Practice 3 cr.

The course covers topics related to the formation, development and evolution of frameworks of public policy. It compares theories and models of policy-making and decision-making to illustrate the special requirements of the country's context and environment. It examines the roles of various participants in the policy process:

legislators, political parties, interest groups, civil society groups, media, administrative structures, citizens and the judiciary. Using a comparative perspective, the course discusses how public policy is formulated, how it changes and why. The course also examines the role of formal and informal institutions, actors, structures and networks including challenges. The course provides students with an increased understanding of theories of public policy, and the ability to critically analyze and compare public policy.

PPIA 304 Development 3 cr.
This course offers students historical, political and policy analysis of development both as a reality and as a concept and discipline in the social sciences. It explains the emergence and continuing relevance of development, offering particular critical attention to the close interdependence between development paradigms, international institutions (UN System, World Bank) and global political economy. The course deepens and broadens students' historical understanding of the antecedents behind contemporaneous global and local development issues and challenges with a critical focus on the interdependence between science, advocacy and policy.

PPIA 305 Economics for Public Affairs 3 cr.
This course reviews the principles necessary to understand economic change and economic policy debates within both regional and international contexts. Starting with the microeconomics theory of the firm and the consumer, students are presented with an analysis of a competitive, monopolistic of markets to explain how the pricing and output decisions of firms depend on market structure and the behavior of competitors. The course also reviews how national income, employment levels, and prices are determined and how government policy can affect macroeconomics outcomes.

PPIA 306 Political Economy 3 cr.
This course provides a critical examination of the politics of international economic relations, global economic development, and transnational economic activity with a special emphasis on the position and experiences of the Middle East states in the global political economy. The course offers a survey of theoretical approaches to international political economy and addresses themes critical to the experience of the Middle East such as state-led industrialization, trade and regionalism, finance, oil, labor migration, MNCs, transnational movements, globalization, neo liberalism, and the politics of development and global governance. *Occasionally.*

PPIA 307 Politics of Policy-Making 3 cr.
The course provides an analysis of the politics of the policy making process in its different stages, from elaboration to implementation, through the examination of a range of policy case studies (urban/spatial, development, environment, energy, social, health, etc.), at different scales (neighborhood, city, region, state, groups of states) and in different contexts (local, regional and international). It equips students to understand how policy ideas are framed into technical and normative discourses that depoliticize policy issues and neutralize power and inequalities. It trains them to identify, trace and deconstruct the political elements that determine how policy paradigms emerge; how policy windows come to be created; how policy actors mobilize, network and advocate their positions; and how policy agendas and tools are negotiated and assembled. It also approaches policy making as a hybrid space between expertise and politics, science and democracy, nature and humanity.

PPIA 308 Research Methods 3 cr.
This course provides students with an understanding of research language, concepts and ethics for the purpose of generating evidence-based research for policy making. It introduces the elements of the research process within quantitative, qualitative and mixed methods approaches, with emphasis on problem formulation, research design, data collection, analysis and reporting. Students will engage in identifying their main research question, selecting appropriate research methods, and designing the relevant data collection and field work to address their research question. They will also learn how to present their research ideas as research proposals for academic, professional and other audiences. Students will also be exposed throughout the course to the variety of public policy tools used to communicate with different publics (memos, briefs, reports, etc.).

PPIA 309 Evidence, Policy and Communication 3 cr.
This course introduces students to the types of questions that need to be answered to address and make improvements to public policy concerns and priorities. including what's the problem; what policy and programmatic options are best suited to address the problem; and how can change be brought about? This course will train students to use the knowledge translation tools and resources available to public policy makers and stakeholders in order to support their use of research evidence; and will enhance students' skills in assessing, selecting, adapting and applying research evidence. Students will experiment with key tools and resources to communicate with different types of policy makers including priority setting, evidence briefs, policy briefs, policy memos, personalized briefing and policy dialogues. This course will provide skills on how to prepare briefs and effective tips on how to communicate evidence (both published and tacit) to policy makers and the public.

PPIA 310 Topics in Public Policy 3 cr.

PSPA 300 Methodology and Research Design 3 cr.
An introduction to the philosophy of science and how it influences the choice of research design. The emphasis is on developing skills that are useful for any method (survey, research, comparative historical analysis, game theory). The objective is to provide students with the practical tools they need to successfully complete original research. *Core course. Annually.*

PSPA 312 Public International Law 3 cr.
A course that aims to provide an understanding of the principles underlying public international law that facilitates relations among states, resolves disputes, protects human rights, allocates resources, and restricts conduct during war time. Emphasis is placed on subfields of international law most closely connected to international politics such as the legal consequences of very serious violations of international law, the role played by the United Nations or the legal regulation of the use of force. Reflecting upon the kind of role international law plays in the conduct of international relations, this course includes many recent case studies and tackles some of the major debates in the field. *Annually.*

PSPA 314 The UN and International Politics 3 cr.
This seminar examines the role of the United Nations (UN) within the context of international politics, security and development. It focuses on the UN role in the Global South, particularly the Arab region. The course explores theoretical perspectives on the role of the UN in world politics and traces the evolution of UN institutions, and in particular UN peacekeeping, from the Cold War to post-Cold War period including the

war on terror. It then considers a series of case studies in depth. The course will include, when possible, guest presentations from UN officials and a field trip to better appreciate the conditions within which UN operations work. *Occasionally.*

PSPA 343/ ENSC 658 **Environmental Conflict Resolution** **3 cr.**
An introduction to contemporary approaches to global environmental negotiation and conflict resolution, including the efforts of international organizations at risk communication, mediation and facilitation. This course focuses on procedures to manage negotiations of environmental conflicts and disputes between governments, corporations, ecologists, the media and the general population. Information is also provided on environmental dispute cases successfully resolved. *Alternate years.*

ENSC 650/ PSPA 316 **International Environmental Policy** **3 cr.**
A course that seeks to provide a broad overview of the key concepts, actors and issues related to global environmental policy. This course outlines the evolution of environmental policy in facing global environmental challenges and how such policies have become inherently intertwined with government policy, business practice and international trade. *Annually.*

PSPA 324 **Government and Politics in Lebanon** **3 cr.**
A course that examines the evolution of the political system and the different approaches to the study of government institutions in Lebanon. This course focuses on patterns of change involving state and society from the founding of the state in the early 1920s to the present. *Occasionally.*

PSPA 345 **Special Topics in Environmental Policy and Politics** **3cr.**
May be repeated for credit. *Occasionally.*

PSPA 346 **Special Topics in Natural Resource Policy and Politics** **3 cr.**
May be repeated for credit. *Occasionally.*

PSPA 351 **New Public Management** **3 cr.**
This seminar is an advanced study and analysis of the field of public administration, from its foundations and origins to the present. It covers topics such as: historical public administration, the traditional model of public administration, new public management and collaborative public administration. The course will also review contemporary research activities and findings related to public administration. *Annually.*

PSPA 352 **Foundations of Public Policy** **3 cr.**
This seminar covers topics related to the substance, methods and frameworks of public policy in a variety of disciplines including: welfare economics, political science, political economy and organization theory. Emphasizing the role of theory in empirical policy research, the course illuminates the various policies and policy challenges in the following substantive areas: economics, education, the environment, national security and immigration. *Annually.*

PSPA 360 Public Policy Research and Analysis 3 cr.
This seminar provides an introduction to policy analysis typologies, policy tools and the factors that shape the utilization of policy analysis. It is designed to give students the theoretical and practical exposure to the process of analyzing public policy as well as to its relevant qualitative, survey and mixed method approaches and techniques. *Annually.*

ENSC 659/ PSPA 362 Public Policy and Administration 3 cr.
This seminar covers topics and frameworks related to the substance and approaches of public policy as they relate to public administration. Students will engage in a serious analysis of the economic, social and cultural assumptions that underpin government and its relationship to the polity. The course is also designed to give students an organized opportunity to investigate their own interests within a specific key policy area. *Annually.*

PSPA 373 The Ethics of Public Administration 3 cr.
This seminar covers contemporary perspectives on ethics and ethical behavior in government. It focuses on the interactions between government and society and analyzes the political, legal, economic and social environments of societal organizations. Some of the contemporary issues addressed are: transparency, accountability and responsiveness, corruptive practices in public administration, administrative discretion and social justice. *Alternate years*.

BIOL 362 Advanced Ecology 3 cr.
A discussion and analysis of topics of current interest in ecology with emphasis on population and community dynamics: as well as methods of ecological investigation and analysis; course includes fieldwork.

ENSC 661/ BIOL 363 Population and Community Ecology 3 cr.
A course that introduces the various models and theories of population dynamics and community structure, and their applications in assessing the complex interactions that occur in natural plant-animal systems as a result of long co-evolution, with emphasis on chemical ecology.

ECON 333 Energy Economics and Policy 3 cr.
A study of the theories related to energy economics, such as economics of natural and energy resources, and the interrelationship between energy, economics and the environment, as well as some important issues in energy policy. *Students cannot receive credit for both ECON 333 and MECH 674. Occasionally.*

ENSC 662/ ECON 338 Economics of Natural Resources and the Environment 3 cr.
An analysis of economic issues regarding the efficient use of natural resources and the management of environmental quality. *Occasionally.*

ENSC 654 Physical and Biological Resources in Terrestrial Ecosystems 3 cr.
Physical and biological resources in ecosystems. Soils in the ecosystem. Soil conservation. Principles of soil chemistry and microbiology. Plant and animal biodiversity. Collection and conservation of wild types. Preservation of endangered species. Plant response to environmental stress. *Alternate years.*

ENSC 655/ AGSC 301 **Statistical Methods in Agriculture** **3 cr.**

An investigation of the statistical techniques needed to design experiments and analyze and interpret agricultural research data. *Prerequisites: STAT 210 or EDUC 227, and CMPS 209. Fall and spring.*

AGSC 376 **Resource and Environmental Economics** **3 cr.**

A course that addresses and analyzes resource and environmental problems facing today's society, with emphasis on providing the student with an intensive introduction to the qualitative theory necessary for an effective analysis of resource problems.

AGSC 384 **Political Economy of Middle East Development** **3 cr.**

A course that provides an understanding of economic development and underdevelopment as it relates to environmental degradation and demographic, social and cultural change; with special application to the economies of the Middle East.

URPL 664 **Urban Land Use Planning** **3 cr.**

This course examines the theory and practice of land use planning as it has developed within the wider practice and theorization of planning. The course explores the ways in which land use controls have been developed and managed in different institutional and regional contexts, unraveling the different conceptualizations of planning that support each of them. Special emphasis is placed on the case of Lebanon where the practice of land use planning is explored through a detailed introduction to planning institutions, agencies and regulations.

URPL 665/ ARCH 062 **Development and Planning Policies** **3 cr.**

The course examines local and regional development and spatial planning projects and policies. It investigates the policy governance and institutional setup, the role of professional expertise, the spatial impacts on the built and un-built environments, as well as the social and environmental impacts. Using case-study analysis of selected cities and regions, students learn how the built environment's growth and development is being managed, across different contexts, by a constellation of stakeholders negotiating conflicting interests, often yielding unequally distributed benefits and costs.

ENSC 695 **Comprehensive Exam** **0 cr.**

ENSC 697 **Project** **3 cr.**

The project must be undertaken, in partial fulfillment of the requirements for the degree, upon the completion of at least 27 credits of core and elective courses. A student who is unable to finish the project in one term can register one additional time.

ENSC 699 **Thesis** **6 cr.**