Interfaculty Graduate Environmental Sciences Program (IGESP)

General Information

The Interfaculty Graduate Environmental Sciences Program (IGESP) leads to the degree of Master of Science (MS) in Environmental Sciences with four possible specializations.

- Ecosystem Management in the Faculty of Agricultural and Food Sciences (FAFS)
- Environmental Health in the Faculty of Health Sciences (FHS)
- Environmental Technology in the Faculty of Engineering and Architecture (FEA)
- 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 (FEA), Health Sciences (FHS), and Medicine (FM), and provides opportunities for study and research in the general field of the 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. 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

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

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

Degree Requirements

Requirements for the degree of Master of Science in Environmental Sciences (any specialization), both thesis and non-thesis options, are tabulated below.

Course	Group	Thesis Option Credits	Non-Thesis Option Credits
Core	A	9	9
Electives	B	15	18
Thesis		6	0
Project		0	3
Total number of credits required for graduation			**30**

Core courses, as well as basic and broad electives, are listed below. These courses are structured to provide students with a diversified and multi-disciplinary background in environmental sciences. Students have to register 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. Specific Faculty/Department requirements are defined under each respective Faculty/ Department.

Group A	Core Courses in Environmental Sciences	Credits
ENSC 630	Natural Resources Management	3
ENSC 640/ENHL 310	Toxicology and Environmental Health Hazards	3
ENSC 650/PSPA 316	International Environmental Policy	3
ENSC 660 is replaced by one of the following courses:	Environmental Technology is replaced by one of the following courses:	3
ENSC 600	Air Pollution and Control I	
ENSC 610	Solid Waste Management I	
ENSC 620	Water and Wastewater Treatment Technology	
ENSC 622	Environmental Chemistry and Microbiology	
ENSC 690*	Seminar in Environmental Sciences	0

Group B	Examples of Concentration Electives	Credits
ENSC 600/CIVE 656	Air Pollution and Control I	3
ENSC 601/CIVE 657	Air Pollution and Control II	3
ENSC 602/CIVE 751	Air Pollution Modeling	3
ENSC 610/CIVE 654	Solid Waste Management I	3
ENSC 611/CIVE 655	Solid Waste Management II	3
ENSC 612/CIVE 658	Industrial/Hazardous Waste Management	3
ENSC 620	Water and Wastewater Treatment Technology	3
ENSC 621/CIVE 653	Water and Sewage Design	3
ENSC 622/CIVE 651	Environmental Chemistry and Microbiology	3
ENSC 623	Physical, Chemical, and Biological Processes	3

* ENSC 690 course should be registered twice by the program's students during their residency at AUB. Otherwise, they are equally encouraged to attend the seminar when offered

ENSC 631	Agricultural Pollution and Control	3
ENSC 632/SIMC 318	Soil Salinity and Management	3
ENSC 633	Ecological Landscape Design and Planning	3
ENSC 641/ENHL 312	Occupational Health	3
ENSC 642/ENHL 314	Environmental Management Systems	3
ENSC 651/CIVE 650	Methods of Environmental Sampling and Analysis	3
ENSC 652/CIVE 659	Environmental Impact Assessment	3
ENSC 653/PSPA 306	Research Methods and Techniques	3
ENSC 654	Physical and Biological Resources in Terrestrial Ecosystems	3
ENSC 655/AGRL 301	Research Design and Statistical Methods	3
ENSC 656/PSPA 352	Policy and Administration	3
ENSC 657/PSPA 317	Environmental Regulation and Legislative Approaches	3
ENSC 658/PSPA 318	Environmental Conflict Resolution	3
ENSC 659/PSPA 362	Policy Analysis and Program Evaluation for Policy Analysts	3
ENSC 661/BIOL 363	Population and Community Ecology	3
ENSC 662/ECON 338	Economics of Natural Resources and the Environment	3
BIOL 390 C	Environmental Biology	3
PSPA 300	Methodology and Research Design[1]	3
PSPA 352	Administration and Public Policy	3

Master of Science in Environmental Sciences—Suggested Curriculum

Thesis Option	**Course**	**Credits**
Term I	**Fall**	**Credits**
ENSC 640	Toxicology and Environmental Health Hazards	3
Any one of the following offered courses		3
ENSC 600	Air Pollution and Control I	
ENSC 610	Solid Waste Management I	
ENSC 620	Water and Wastewater Treatment Technology	
ENSC 622	Environmental Chemistry and Microbiology	
ENSC 690*	Seminar in Environmental Sciences	0
ENSC 69_	Elective	3

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1 Recommended course for ENVP students

Term II	Spring	Credits
ENSC 630	Natural Resources Management	3
ENSC 650	International Environmental Policy	3
Any one of the following offered courses		3
ENSC 600	Air Pollution and Control I	
ENSC 610	Solid Waste Management I	
ENSC 620	Water and Wastewater Treatment Technology	
ENSC 622	Environmental Chemistry and Microbiology	
ENSC 69_	Elective	3

Term III	Summer	Credits
ENSC 699	Thesis	6

Term IV	Fall	Credits
ENSC 69_	Elective	3
ENSC 690*	Seminar in Environmental Sciences	0
ENSC 699	Thesis (continued)	

Term V	Spring	Credits
ENSC 69_	Elective	3
ENSC 699	Thesis (continued)	–

Term VI	Summer	Credits
ENSC 699	Thesis (continued)	-
		Total 30

Non-Thesis Option	Course	Credits
Term I	**Fall**	**Credits**
ENSC 640	Toxicology and Environmental Health Hazards	3
Any one of the following offered courses		3
ENSC 600	Air Pollution and Control I	
ENSC 610	Solid Waste Management I	
ENSC 620	Water and Wastewater Treatment Technology	
ENSC 622	Environmental Chemistry and Microbiology	
ENSC 690*	Seminar in Environmental Sciences	0
ENSC 69_	Elective	3

* ENSC 690 course should be registered twice by the program's students during their residency at AUB. Otherwise, they are equally encouraged to attend the seminar when offered

Term II	Spring	Credits
ENSC 630	Natural Resources Management	3
ENSC 650	International Environmental Policy	3
Any one of the following offered courses		3
ENSC 600	Air Pollution and Control I	
ENSC 610	Solid Waste Management I	
ENSC 620	Water and Wastewater Treatment Technology	
ENSC 622	Environmental Chemistry and Microbiology	
ENSC 69_	Elective	3

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

Term IV	Fall	Credits
ENSC 69_	Elective	3
ENSC 690*	Seminar in Environmental Sciences	0

Term V	Spring	Credits
ENSC 697	Project	3
Total 30		

Course Descriptions

ENSC 600/ CIVE 656 **Air Pollution and Control I** **3 cr.**

Introduction to air pollutants, sources, and effects. Emissions estimates, regulations, and monitoring techniques. Particulate matter characterization. Meteorology and atmospheric dispersion. Air pollution control processes. *Prerequisite: CHEM 202 or equivalent. Annually.*

ENSC 601/ CIVE 657 **Air Pollution and Control II** **3 cr.**

Process analysis, operational limitations, cost and performance, and evaluation of control process and equipment. Case studies, field visits, and inspection of industrial installations. *Prerequisite: ENSC 600 or consent of instructor. Alternate years.*

ENSC 602/ CIVE 751 **Air Pollution Modeling** **3 cr.**

Air pollution meteorology. Plume rise. Dispersion and atmospheric chemistry. Meteorological models. Gaussian, statistical, and other special application models. *Prerequisite: ENSC 600 or consent of instructor. Alternate years.*

ENSC 610/ CIVE 654 **Solid Waste Management I** **3 cr.**

Nature and effects of solid wastes, including hazardous wastes. Engineering management principles, practices, and techniques for management of solid wastes. Solid waste generation, storage, collection and transport, processing, resource recovery, and disposal. Trip to a local facility. *Annually.*

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ENSC 611/ CIVE 655 **Solid Waste Management II** **3 cr.**
Design of solid waste disposal schemes, including design reports and literature search on the development of conventional treatment and disposal processes. *Prerequisite: ENSC 610 or consent of instructor. Alternate years.*

ENSC 612/ CIVE 658 **Industrial/Hazardous Waste Management** **3 cr.**
Sources, quantity, and quality of industrial wastes. Basic industrial waste treatment processes. Major industries, types of wastes, and existing treatment practices. Disposal and fate of industrial wastes. *Alternate years.*

ENSC 620 **Water and Wastewater Treatment Technology** **3 cr.**
Quality and methods of treatment of water and wastewater. Literature search on the development of conventional treatment processes. *Students who have taken CIVE 086 cannot register for this course. Annually.*

ENSC 621/ CIVE 653 **Water and Sewage Works Design** **3 cr.**
Design of wastewater schemes, including design reports and literature search on the development of conventional treatment processes. *Prerequisites: CIVE 076, CIVE 586, and ENSC 620, or consent of instructor. Alternate years.*

ENSC 622/ CIVE 651 **Environmental Chemistry and Microbiology** **3 cr.**
Introduction to the quantitative aspects of organic, inorganic, and physical chemistry. Homogeneous and heterogeneous solutions. Chemical equilibria. Reaction kinetics. Acidity, alkalinity, hardness, colloids, and solids. Introduction to the composition, morphology, life characteristics, and broad classification of microorganisms. Biochemistry, including energy, metabolism, and synthesis. Population, growth, decay, and biochemical kinetics in biological processes. Biological water quality indicators. *Prerequisites: CHEM 201, BIOL 210, or equivalent. Alternate years.*

ENSC 623 **Physical, Chemical, and Biological Processes** **3 cr.**
Physical-chemical processes: coagulation, flocculation, softening, iron and manganese removal, sedimentation, sand filtration, chlorination, and principles of desalination. Biological processes: trickling filter, biological disks, activated sludge, and waste stabilization ponds. Sludge treatment. *Prerequisites: ENSC 620 and ENSC 622, or consent of instructor. Alternate years.*

ENSC 630 **Natural Resource Management** **3 cr.**
Ecosystem approach to NRM. Data sources and interpretation for NRM. Physical, socio-economic, cultural, political, and geographic specificity of NRM. Principles and processes of NRM. Case studies and practical examples in contrasting situations.

ENSC 631 **Agricultural Pollution and Control** **3 cr.**
Fate of agrochemicals in the environment. Effect on terrestrial and aquatic systems. Contamination, monitoring residues, methodologies, and risk assessment models and research. *Annually.*

ENSC 632/ SIMC 318 **Soil Salinity and Management** **3 cr.**
Diagnosis and properties of salt-affected soils; plant growth and salinity. Water quality for irrigation, drainage, reclamation, and management of saline and sodic soils. *Alternate years.*

ENSC 633 Ecological Landscape Design and Planning 3 cr.
Introduction to the theory and methodology of ecological landscape design and planning, aims to introduce the holistic approach of landscape ecology and its application in sustainable management of natural and cultural landscape sterosystems. *Alternate years*.

ENSC 640/ ENHL 310 Toxicology and Environmental Health Hazards 3 cr.
Reviews of the essentials of toxicology: dose response, toxicokinetics (absorption, distribution, metabolic conversion, elimination), and the molecular basis for toxic action, target organ toxicity, mutagenesis, teratogenesis, and carcinogenesis. Selected chemical agents that adversely affect human health are introduced as case studies. Concepts of risk assessment. *Annually*.

ENSC 641/ ENHL 312 Occupational Health 3 cr.
Conditions and hazards in occupational environments, and control and effect on workers and the neighborhood. Administrative aspects of occupational health programs in industries and monitoring of occupational environments. *Annually*.

ENSC 642/ ENHL 314 Environmental Management Systems 3 cr.
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 firms. It provides students with the skills to design, implement and assess 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 prepare a technical report on a firm or industry of their choice and to communicate project findings to their colleagues through verbal presentation. Emphasis is placed on solving environmental problems using an integrated approach in order to achieve an optimized management performance. *Alternate years*.

ENSC 650 International Environmental Policy 3 cr.
This course seeks to provide a broad overview of the key concepts, actors, and issues related to global environmental policy. It outlines the evolution of environmental policy in facing global environmental policy, in facing global environmental challenges, and how such policies have become inherently intertwined with government policy, business practice, and international trade. Ethical considerations in relation to the environment are also addressed. *Annually*.

ENSC 651 Methods of Environmental Sampling and Analysis 3 cr.
Theory and practice of sampling techniques and instrumental methods used in environmental sciences and technology, with emphasis on the determination of pollutants in water, air, and soil by modern analytical techniques. Adaptation of procedures to specific environmental matrices through case studies and practical application. *Alternate years*.

ENSC 652/ CIVE 659 Environmental Impact Assessment 3 cr.
Theories and procedures of assessing environmental impact. Analysis of the impact of development on various measures of environmental quality. Benefit-cost considerations in environmental impact assessment. Cost of environmental degradation: methodologies and case studies. *Prerequisites: ENSC 600, ENSC 610, and ENSC 620, or consent of instructor. Alternate years*.

ENSC 653/ PSPA 306 Research Methods and Techniques 3 cr.

A course that deals with various methods of data collection and analysis. Specific research methods include both quantitative and qualitative techniques such as experimental, survey, field observation, content analysis, historical/comparative, and evaluation. *Offered 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/ AGRL 301 Research Design and Statistical Methods 3 cr.

Non-experimental observational studies. Survey research instrumentation and analysis. Factorial design and analysis. Model testing and validation. Basic statistical concepts. Regression and correlation analysis. Analysis of variance and co-variance. Chi square and other non-parametric tests. *Prerequisite: MATH 208 or equivalent. Alternate years.*

ENSC 656/ PSPA 352 Policy and Administration 3 cr.

A course that studies policy-making environments as sub-systems of larger social and political contexts. This course compares the way policymakers and administrators in different cultural and socio-economic settings deal with globalization, the nature and substance of politics and administration, and the relations between governmental and non-governmental actors. *Alternate years.*

ENSC 657/ PSPA 317 Environmental Regulation and Legislative Approaches 3 cr.

An introduction to environmental law and contemporary legislative approaches to environmental protection, the rationales, and their effectiveness in achieving prescribed goals. This course is divided into three main modules. The first module will introduce students to the basic principles of International and national environmental law. The second module will cover contemporary European, US and selected developing country approaches to environmental law-making, while the final module will analyze environmental legislative approach taken in the case of Lebanon. *Annually.*

ENSC 658/ PSPA 318 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 659/ PSPA 362 Policy Analysis and Program Evaluation for Policy Analysts 3 cr.

A course that introduces students to a wide array of quantitative techniques and skills used by public managers to analyze policy-related data and problems. This course covers different theoretical and applied frameworks for evaluating policy options, as well as program assessment and improvement. *Offered occasionally.*

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. *Prerequisite: Consent of instructor.*

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. *Annually.*

ENSC 690 Seminar in Environmental Sciences 0 cr.

Current research or applied projects are presented by faculty members, students, or invited speakers. *Annually.*