



**The University of Jordan  
Faculty of Engineering and Technology**

**A Master's Program Proposal  
Environmental Technology and Climate Changes**

**2013**

Plan no.			2013	T
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## Study Plan for Master Degree in Environmental Technology and Climate Changes

**Master program in Environmental Technology and Climate Changes  
Degree Offered: M.Sc / Thesis Track**

### **A. General Rules and Conditions:**

1. This plan conforms to the valid regulations of programs of graduate studies
2. Areas of specialty for admission to the M.Sc. Program:
  - Holders of the bachelor's degree in:
    - Environmental Engineering,
    - Civil Engineering,
    - Chemical Engineering,
    - Mechanical Engineering,
    - Architecture Engineering,
    - Electrical Engineering,
    - Industrial Engineering,
    - Mechatronics Engineering, and
    - Computer Engineering.
  - Bachelor degree in any discipline of knowledge on a condition of passing certain courses the student, which will be determined case by case

### **B. This Study Plan consists of 33 credit hours as follows:**

#### 1. Obligatory Courses (15 credit hours)

Course No.	Course Title	Credit Hours	Pre-req.
0934741	Scientific Research Methods	3	-
0941772	Air Pollution	3	-
0904775	Climate Change Impacts and Adaptation	3	-
0935757	Environmental Impacts of Energy	3	-
0932731	Environmental Design	3	-

2. Elective Courses (9 credit hours to be selected)

Course No.	Course Title	Credit Hours	Pre-req.
0905759	Industrial Processes and Pollution Prevention	3	-
0905776	Hazardous Substances and Waste Management	3	-
0931776	Simulation in Environmental Engineering	3	-
0941787	Remote Sensing	3	-
0902732	Building Preserving and Reusing	3	-
0904763	Environment and Sustainable Development	3	-
0904751	Renewable Energy Systems	3	-
0904777	Environmental law and policies	3	-
0941771	Biological Treatment of Wastewater	3	-
0904776	Disaster risk reduction	3	-
0905734	Environmental Economics	3	-
0902739	Energy efficiency in Buildings	3	-
0904778	Special Topics in Environmental Technology and Climate Change	3	-

3. (0904799) Thesis (9 Credit hours)

## **Courses Description**

**0934741**                      **Scientific                      Research                      3 credit hours**  
**Methods**

In this course students learn how to carry out different stages of scientific research starting from the formulation of research idea and finishing by a write up and presentation of a technical report. The course is in the form of lectures taught by faculty and invited speakers in which various types of research and different case studies in the advanced fields of energy engineering will be presented. As a part of the course, students will undertake at least one small research projects under the supervision of faculty members to learn how to define the problem and complete the literature review using various resources including the Engineering Index Journal list and other relevant internet sources. Measurement systems and instruments, acquisition of thermo fluid dynamic parameters, elements of technical design and drawing, elements of mechanical manufacturing (manufacturing devices) will be introduced.

Additionally students will gain knowledge on to how use in their projects appropriate analytical and numerical solutions and experimental methods. The general structure of their project reports will indicatively include the following sections: Abstract, Introduction, Analysis, and Description of the experiment, Experimental procedure, Results, Discussion and Conclusions, Recommendations and, finally, References.

**0941772**                      **Air Pollution                      3 credit hours**

Background and basic definition, sources of air pollution, atmospheric transport of pollutants properties of gaseous and particulate matter, sampling, analysis and design (theory, equipment and techniques), physical analysis of particles and specific tests, acid and alkaline rains and their hazards on public health, particulate and gases control methods and their design odor control, noise pollution.

**0904775**                      **Climate Change Impacts and                      3 credit hours**  
**Adaptation**

Climate change is likely to have far-reaching and catastrophic social impacts and will affect communities in different ways. Vulnerability to climate change impacts depends on differences in geography, technological resources, governance and wealth. The course should cover following issues: weather and climate, natural and anthropogenic forcing of climate, greenhouse gasses, past climates, indicators of climate change, predicting future climate, climate change policies, Kyoto Protocol, Copenhagen Accord, intergovernmental panel of climate change (IPCC), scenarios of climate change, devastating impacts of climate change, mitigation and adaptation.

**935757**

**Environmental Impact of Energy**

**3 credit hours**

This course deals with the environmental impacts and consequences of energy producing systems. It deals with the general terminology related to the environmental field, as well as, identification of key-pollutants and impacts on humans and the environment. The impact of various energy producing systems is compared and discussed. Finally, environmental impact assessment (EIA) approach is introduced and discussed.

Various forms of pollution: particulate emissions, gaseous emissions, and solid waste in addition to thermal pollution. Systems and equipment for waste treatment and desulfurization techniques. NO<sub>x</sub> control through better design of burners and furnaces. Environmental monitoring systems and environmental impact assessment.

**0932731**

**Environmental Design**

**3 credit hours**

The environmental forces climatic features and their impact on architecture .the human comfort zone in relationship to temperature and relative humidity inside building. Natural and artificial means of environmental control and their effect on the microclimate of building .architectural devices which alleviate extreme weather conditions. examples of buildings which apply different methods environmental control both natural and artificial .

**0905759**

**Industrial Processes and Pollution  
Prevention**

**3 credit hours**

This course introduces the pollution prevention and waste minimization concepts, terminologies, life cycle impacts, and management strategies. As well as, it presents the available techniques for industrial pollution control and prevention. Topics include current state of knowledge of pollution prevention approaches to encourage pollution prevention strategies such as cleaner production and eco-efficiency strategies through which the clean technologies and clean products, technical and economic issues, incentives and barriers to pollution prevention are covered, in addition to the role of different sectors in promoting pollution prevention. Pollution prevention and waste minimization techniques such as waste reduction, chemical substitution, production process modification, and reuse and recycling will be addressed to selected industries such as paints, electroplating, pulp and paper, and poultry and food industries.

**0905776**

**Hazardous Substances and Waste  
Management**

**3 credit hours**

This course will present the history, rationale, current laws and regulations governing the proper management of hazardous and toxic substances and wastes, as well as present methods for control and remediation of these hazardous wastes in the environment. The course identifies the technical methods which categorize hazardous waste and describes the regulations relating to hazardous waste and hazardous material management, transportation, treatment and community right to know. It applies key concepts and principles in order to describe and distinguish methods for the treatment, disposal and storage of hazardous wastes. Moreover, it also applies key principles in order to describe the movement of hazardous wastes in ground waters, and methods for the treatment and remediation of these ground waters.

**0931776**

**Simulation in Environmental  
Engineering**

**3 credit hours**

Material balance formulation , mass transfer processes, biological and chemical kinetics, ideal flow reactors, general flow systems, gas Exchange and stream reparation dissolved exchange and stream reparation, dissolved oxygen balance equations , streams, lakes and estuarine analysis, modeling of biochemical oxygen demand, nitrification, photosynthesis and other water quality parameters, general applications .

**0941787**

**Remote Sensing**

**3 credit hours**

Introduction to remote sensing, Fundamentals of remote sensing, Remote sensing satellites (Landsat, SPOT, IKONOS), Vectors (aircraft, artificial satellites), Sensors, Data used in remote sensing, Image interpretation, Applications of remote sensing, Segmentation, Classification.

**0902732**

**Building Preserving and Reusing**

**3 credit hours**

The comprehensive context of sustainable development with special reference to developing communities. factors of sustainable development and the role which architecture plays in ecological balance. The use of natural resources in the development process. selected examples of green architecture and the conservation of energy. Renewable energy and its application in building. Social, economic and technical dimensions in sustainable development. Examples of human technical dimensions in sustainable development. Examples of human settlements which use renewable energy. Criteria of sustainable development.

**0904763**

**Environment and Sustainable  
Development**

**3 credit hours**

This course introduces students to theory and practice of environment and sustainable development at the international, national and urban levels in a variety of contexts. It also examines examples of environmental degradation by vectors such as deforestation, loss of biodiversity, pollution, soil erosion, decreasing quality and quantity of water, poor sanitation services and poor urban conditions; CO2 emissions and global warming, interactions among society, development and environment, and their implications for sustainable development; technical, economic, ethical and philosophical aspects of sustainable development.

**0904751**

**Renewable Energy Systems**

**3 credit hours**

The main types of renewable energy and the concept of distributed power generation will be illustrated in this course. In particular the usefulness of various types of energy systems as they relate to the future of this planet will be demonstrated. Topics will include: passive and active solar systems (high, medium and low temperature thermal solar collectors; photovoltaic systems of the first, second and third generations); wind energy and integration of wind and solar power systems into the electricity grid; biomass and bio-energy; waste management; hydrogen (fuel cells and other uses); hydroelectric power; geothermal heat transfer. Students will be introduced to the practical aspects of renewable energy systems design development, exploitation and monitoring.

Information on each technology will be presented using the same training approach: general presentation; main characteristics, operational principles, application, technical aspects of installation and maintenance; basic introduction to the relevant market and financial management, policies, regulations and incentives; dissemination of both positive and negative national and international practice and experience.

In conclusion, there will be an introduction to social, legal and market challenges to assist students to identify prospective of RE technologies at early stages and a range of factors affecting the deployment of RE systems.

**0904777**

**Environmental law and policies**

**3 credit hours**

This course serves as an introduction to Ecology (the science of environment) from a legal aspect. The course begins with an introduction to environmental law and its history on both national and international levels. Then the student will be able to recognize different mechanisms of environmental litigations which built on the idea of interconnection between different disciplines.

The course will examine the post-Rio environmental policy effects on the conception and development of environmental law as a law owning its own features, also will look into its common grounds with other human rights laws, focusing on the right of clean environments as one of the human rights provided for by the international covenant adopted by the U.N.

The course emphasises the participatory aspect of Ecology ,with all its sub-divisions, on one hand and the legal science on other hand, and the positive outcome that this idea of participation may play in producing a real environmental legislation that meets precisely with its goals, as well as proper legal drafting tools.

The course includes several case studies, which require students to think strategically about how they would solve real world problems that have confronted lawyers, policymakers and engineers. Students are also expected to participate actively in classroom discussions.

**0941771**

**Biological Treatment of  
Wastewater**

**3 credit hours**

Principles of biological oxidation, treatment Kinetics, aeration and mass transfer principles, design of treatment processes. Activated sludge, trickling filters, stabilization ponds, sludge handling and treatment, aerobic and anaerobic digestion, anaerobic filters, anaerobic ponds, anaerobic contact processes, principle and design for nitrification-denitrification.

**0904776**

**Disaster risk reduction**

**3 credit hours**

Introduction to DRR: General risk and disaster trends worldwide; Basic terminology (DRR, risk, vulnerability, exposure, hazard) and differences between DRR and CCA; From the disaster cycle to the disaster spiral – moving from reaction to prevention and Actors involved in DRR at international, national and local levels. Linking Climate Change Adaptation and DRR: impacts of CC on disasters; impacts of CC on ecosystems; impacts of CC on vulnerability and Streamlining CC adaptation and DRR. Linking global environmental problems and disasters: Linkages between human – natural systems; Climate change/variability, adaptation and DRR; Biodiversity loss and DRR; Global water crisis and DRR; Desertification and erosion and DRR and Linkages between SDGs (Rio + 20) and disasters. Linking Sustainable development, Disasters and Environment: disasters effect on sustainable development and links between disasters and environment.

**0905734**

**Environmental Economics**

**3 credit hours**

Connecting micro and macro evaluations on middle level, economic studies is to seize the importance of the flows, measure them together with their transformations and impacts on the environment. Then, the consequences of these actions are translated into economic monetary terms, first into environmental degradation costs (damages and inefficiencies), second, into remediation costs. The value added ( VA) of the concerned entity. Last, prospective scenario is run in order to assess the evolution of environmental damage and economic inefficiencies over time.

**0902739**

**Energy efficiency in Buildings**

**3 credit hours**

Introduction to the nature of how buildings consume different types of energy, analysis of energy consumption through the life cycle of a building, construction, operation, and demolition of the building. Studying the negative effects of building's energy consumption on the environment. Why buildings consume energy. Standards and regulations related to the management of energy consumption of buildings.

## Faculty Members for Master Program in Environmental Technology and Climate Change

<b>Member</b>	<b>Specialty field</b>	<b>Department</b>	<b>Faculty</b>
Prof. Ahmed Al-Salaymeh	Thermals/ Fluid Mechanics & Renewable Energy	Mechanical Engineering	Engineering and Technology
Prof. Mahmoud Battah	Remote Sensing	Civil Engineering	Engineering and Technology
Dr. Abdulsalam Alshboul	Technology of Architecture	Architecture Engineering	Engineering and Technology
Dr. Ahmad Sakhrieh	Thermals/ Combustion	Mechanical Engineering	Engineering and Technology
Dr. Motasem Saidan	Pollution Prevention	Chemical Engineering	Engineering and Technology
Prof. Mohamed Ahmad Hamdan	Thermals/ Combustion	Mechanical Engineering	Engineering and Technology