MCAST MASTER OF SCIENCE IN ENVIRONMENTAL ENGINEERING

CODE: UC7-E7-18
Launching November/December 2020

Online Application and Cost Details Available at:
https://shortcourses.mcast.edu.mt/courses/MASTERS

Entry Requisite: First degree in business; engineering; ICT; Environmental; Product Design.

Delivery Mode - Blended Learning over 5 Semesters (2 ½ Years): 7 Modules taught in a total of around 30 weekend campus sessions (a weekend session consists of a Friday evening lecture from 17:30 to 20:30 and a Saturday morning lecture from 9:00 to 13:00) and 3 modules carried out online through eLearning using the MCAST Moodle Platform.

The Master of Science in Environmental Engineering programme takes an interdisciplinary approach into the investigation of processes that control the earth and its environment. The programme will deliver all necessary knowledge and skills to seize opportunities presented by new developments in areas such as global cycles, biogeochemistry, sustainable technologies, waste and water treatment, environmental pollution assessment and remediation, and natural hazard. A special focus on environmental auditing and impact assessment shall be made, particularly in water, energy, noise and traffic auditing.

Learning Outcomes:

Upon successful completion of this Masters Programme the participants will be able to:

1. *Evaluate the performance of an engineering system and incorporate innovations or implement new technologies*
2. *Enhance environmental protection;*
3. *Collect, construct and evaluate environmental impact data;*
4. *Apply knowledge in the fields of energy efficiency, waste water treatment, marine protection and water resource management;*
5. *Use logic and reasoning to identify the strengths and weaknesses of alternative environmental sustainability solutions.*

First Year (Semesters 1 & 2: 30 ECTS) – Exit Option: Post Graduate Certificate

1. Introduction to Environmental Engineering
2. Environmental Impact Assessment
3. Environmental and Soil Science
4. Ecosystem Analysis and Management
5. Energy Efficiency and the Environment

Second Year (Semesters 3 & 4: 30 ECTS) – Exit Option: Post Graduate Diploma

6. Marine Pollution
7. Renewable Energy Technologies
8. Air Pollution and Monitoring
9. Sustainable Urban Transport
10. Electives:

10.1 - Water Resources and the Environment
10.2 - Water Contamination and Remediation

Third Year (Semester 5: 30 ECTS) – Final Exit: Masters

Dissertation

STUDY UNIT 1

Introduction to Environmental Engineering

MQF Level 7

6 ECTS

E-learning: No

Rationale

A survey of the sources, measurement techniques and treatment technologies that relate to environmental pollution resulting from human activities. This unit is technology-focused but also touches on topics related to the implementation of technology in the real world such as public perception, policy and legislation, and choosing between technological alternatives. Topics include water pollution, air pollution, solid waste, the fate and transportation of pollutants in the environment, and pollution prevention. The consideration of each area includes the general background and key concepts, detailed design examples, and current topics.

Learning Outcomes

A student who has met the objectives of the unit will be able to:

1. Understand the basic mechanisms of environmental problems;
2. Apply environmental management principles;
3. Implement the fundamental concepts of mass balance;
4. Explain air pollution and the fundamentals of climate change;
5. Understand the importance of water and identify the problems of water pollution;
6. Explain the problem of land pollution;
7. Understand the basic mechanisms of green design;
8. Analyse and interpret the importance of public participation in environmental management;

STUDY UNIT 2

Environmental Impact Assessment

MQF Level 7

6 ECTS

E-learning: Yes

Rationale

This unit will attempt to: describe the necessity of Environmental Impact Assessment (EIA), define the base influential parameters of EIA, recognise the main environment attributes, describe the baseline environment, use adequate prediction and methods of assessment of impacts and introduce public participation in the environmental decision making process.

Learning Outcomes

A student who has met the objectives of the unit will be able to:

1. Understand the basic mechanisms of sustainable development;
2. Understand the basic concepts of environmental impact assessment;
3. Define the detailed contents of an EIA;
4. Recognise the main environmental attributes;
5. Describe the baseline environment based on the environmental setting, selected parameters, monitoring of physical environmental parameters, collection and interpretation of baseline data for various environmental attributes;
6. Use adequate prediction and methods of assessment of impacts on various aspects of the environment;
7. Understand public participation in the environmental decision making process;
8. Prepare an environmental management plan;

STUDY UNIT 3

Environmental and Soil Science

MQF Level 7

6 ECTS

E-learning: No

Rationale

This unit represents a comprehensive study related to the origin of soils; chemical, morphological and physical soil properties; the principles of soil classification and soil mapping through Geographic Information Systems technology (GIS). GIS is a powerful data visualisation and analysis tool and this unit is designed to introduce students to the advanced concepts of geographic information science related to the fields of reserve planning, environmental science, natural resources, and ecology for the purpose of spatial analysis and the geo-visualisation of environmental issues. Topics include conservation needs using remote sensing, digital image processing, data structures, database design, landscape ecology and metrics, wildlife home range and habitat analysis, suitability modelling, terrain and watershed analysis and spatial data analysis.

Learning Outcomes

A student who has met the objectives of this unit will be able to:

1. Outline the soil genesis and classification, soil properties and processes, soil mapping and geo statistics;
2. Evaluate critically the importance of soil resources in certain sectors, as well as the implementation of environmental issues;
3. Identify GI Science concepts and understand how these are used to gather, manage, quality check, process, analyse, model, and interpret environmental spatial data;
4. Evaluate critically the environmental GIS data and information produced by the government, agencies, industry, academia, and popular media;
5. Identify environmental spatial data required for particular tasks and locate environmental spatial data that is available and has been quality assessed;

6. Use commonly available GIS and remote sensing software to view, assess, and present spatial datasets:
7. Develop, analyse and produce research to examine a real-world environmental issue of interest for the final project;
8. Present products of own environmental analyses in written and oral/visual form;

STUDY UNIT 4

Ecosystem Analysis and Management

MQF Level 7

6 ECTS

E-learning: No

Rationale

To enable analysis, understanding and management of human-environmental systems; define the basics of system analysis and ecosystem theory; analyse human-environmental interactions through land-use conflicts between agriculture, environmental protection, urban expansion, water management, tourism etc.; define a crucial concept in nature conservation – biological diversity; and link advanced methods of system analysis and ecological modelling with modern methods of natural resource management.

Learning Outcomes

A student who has met the objectives of the unit will be able to:

1. Understand the basics of human-environmental systems interaction;
2. Understand the basic concepts of system analysis and ecosystem theory;
3. Analyse human-environmental interactions using various examples
4. Understand biological diversity in relation to environmental engineering;
5. Recognise advanced methods of system analysis and ecological modelling with modern methods of natural resource management;
6. Perform ecosystem service assessments;

STUDY UNIT 5

Energy Efficiency and the Environment

MQF Level 7

6 ECTS

E-learning: Yes

Rationale

This unit attempts to highlight the basic issues associated with the relationship between material/energy resources, the environment and sustainable development. The potential directions for technological changes on the greater efficiency of energy utilisation, exploitation of renewable energy, adoption of cleaner environmental practices in waste reduction that can lead to sustainable development will be explored. The management of energy and the environment towards sustainability will be introduced.

Learning Outcomes

A student who has met the objectives of this unit will be able to:

1. Identify energy consuming equipment within a building and in the building envelope, and research all possible energy conservation measures in the areas of HVAC, lighting, motors, building envelope, and other building equipment;
2. Identify and operate various data acquisition, monitoring, auditing, and system balancing equipment for energy analysis;
3. Analyse possible energy conservation measures for performance, including the interactive effects of multiple ECMs;
4. Compare occupancy schedules to operating schedules and recommend appropriate adjustments to optimise building and energy usage and calculate energy savings;
5. Analyse energy consumption, including an analysis of the viability of switching to alternative/renewable fuels;
6. Investigate energy usage scenarios to determine the optimal rate from energy suppliers or to determine if the customer qualifies for an alternative rate;

7. Analyse the opportunities for improving the operation, maintenance and energy efficiency of each energy system and piece of equipment at a building site;
8. Recognise the results of the ECM analyses by energy savings, economic savings and environmental impacts;

STUDY UNIT 6

Marine Pollution

MQF Level 7

6 ECTS

E-learning: No

Rationale

This unit will provide a full understanding of marine pollution. The different sources and types of contamination will be detailed, including chemical, physical and biological pollution. Students will study the dispersion of this contamination and the main contaminated areas. The effects on the organisms and on the health of the ecosystems, and the treatments and possible solutions will also be developed.

Learning Outcomes

A student who has met the objectives of the course will be able to:

1. Identify the main sources of marine pollution;
2. Identify the main pollutant activities;
3. Identify the impacts in society and ecosystem health;
4. Identify the types, origin and effects of each pollutant;
5. Recognise the methods of remediation pollution;
6. Identify the main international agreements related to marine pollution in the last 25 years;

STUDY UNIT 7

Renewable Energy Technologies

MQF Level 7

6 ECTS

E-learning: No

Rationale

Current environmental issues, climate change, global social injustice, and the impacts of these on ecosystems and societies have led us to radically rethink our current energy systems. It is necessary for us to understand how humanity became so dependent upon fossil fuels, and it is even more important for us to understand what other alternative energies exist. This unit will examine the technical, economic, and political aspects of renewable energy and students will learn about the successes and failures of implementing alternative energies at the local, national, and regional levels.

Learning Outcomes

A student who has met the objectives of the unit will be able to:

1. Understand the basics of energy systems;
2. Explain the importance of res;
3. Define the possibilities for res utilisation;
4. Analyse and interpret the importance of res in the energy system using SWOT and best practices;

STUDY UNIT 8

Air Pollution and Monitoring

MQF Level 7

6 ECTS

E-learning: No

Rationale

To describe air pollution sources, atmospheric transport, dispersion and transformation processes, deposition, uptake and impacts on human health and the environment and to introduce techniques of air pollution detection and monitoring as well as to familiarise unit participants with the equipment used for this purpose.

Learning Outcomes

A student who has met the objectives of this unit will be able to:

1. Understand the mechanisms of air pollution;
2. Carry out a basic assessment of the health-affecting air pollutants;
3. Present contemporary global environmental issues such as climate change and ozone holes;
4. Propose solutions for environmental problems with emphasis on air pollution;
5. Apply working knowledge of mathematics, science, and engineering science to understand air pollution, and identify possible environmental engineering interventions;
6. Determine the political and economic actors in relation to solving air pollution problems from a local to regional and global scale;
7. Relate health and safety needs in terms of air pollutants;
8. Analyse, interpret, and communicate environmental data related to urban air pollution;
9. Conduct the relevant measurements of key air pollutants;
10. Evaluate the key air pollutants and their environmental impact from important sectors
11. Use procedures and methods for hydrocarbons and heavy metal particles for air concentration detection in urban areas;
12. Asses the effect of possible preventive measures that can be utilised in environmental engineering;

STUDY UNIT 9

Sustainable Urban Transport

MQF Level 7

6 ECTS

E-learning: Yes

Rationale

This unit explores the relationships between transportation infrastructure, technology, and energy consumption, with a focus on the potential impacts of alternative futures for transportation and energy systems. We will couple lectures, literature review, and class discussions with scenario and data analysis. Students will explore the potential changes in well-to-wheel energy consumption and greenhouse gas emissions associated with alternative energy scenarios applied to specific transportation subsectors.

Learning Outcomes

A student who has met the objectives of this unit will be able to:

1. Understand the trends and problems of the transport sector;
2. Define and understand the different alternative fuels;
3. Evaluate the possibilities for alternative fuels;
4. Explain air pollution reduction;
5. Understand the comprehensive strategies to reduce long-term transportation energy use and GHG emissions;
6. Analyse and interpret the importance of sustainable urban transport;

STUDY UNIT 10.1 (ELECTIVE)

Water Resources and the Environment

MQF Level 7

6 ECTS

E-learning: No

Rationale

This unit provides a multi-disciplinary understanding of water resources and environmental issues. It's designed to develop the knowledge and skills necessary to plan and manage resources within the context of climate change and the environment. With growing worldwide issues over water resources, this sector is becoming ever more important.

Learning Outcomes

A student who has met the objectives of the unit will be able to:

1. Determine the water resources in a certain location;
2. Estimate the hydro-potential for energy use and its impact of the environment;
3. Plan efficient and sustainable water use in all aspects of modern life;
4. Understand the methods and techniques used for water purification and recycling;
5. Implement measures for water purification and recycling in industrial facilities and in everyday life;
6. Project water consumption quantity based on the latest technology demands in a particular industrial facility;
7. Evaluate the impact of water consumption on the local environment;

STUDY UNIT 10.2 (ELECTIVE)

Water Contamination and Remediation

MQF Level 7

6 ECTS

E-learning: No

Rationale

This unit on water contamination and remediation exposes the different contaminants that can be present in the water and the treatments normally used to depurate it. The depuration of water can involve methods to depurate drinking water or techniques that permit the return of the water after its use for different processes to the environment in the appropriate conditions.

Learning Outcomes

A student who has met the objectives of the course will be able to:

1. Investigate the properties of the water molecule;
2. Understand the water cycle;
3. Identify the uses of water;
4. Evaluate the different types of contamination experienced by water;
5. Explain the different methods of obtaining water for consumption;
6. Describe the different steps of sewage treatment;