MCAST

MQF Level 7

AS7-08-21

Master of Science in Integrated Water Resource Management

Course Specification

Course Description

The Master of Science in Integrated Water Resource Management programme shall impart in-depth knowledge and practical experience in applied science aspects of water systems in small island states, with a focus on water measurement, water sustainability, water consumption, water chemistry, microbiology and analytics. The course comprises a range of practical modules in water metering, sensing and measurement, applied microbiology, biofouling/biocorrosion, chemometrics, environmental microbiology and water chemistry.

Programme Learning Outcomes

At the end of the programme the students are able to;

1. *Understand the basics in natural sciences, environmental hydraulics, hydrology and water resource management.*
2. *Understand water management related topics Apply knowledge in all areas of water resource management, water supply, waste water treatment and solid waste management.*
3. *Investigate to obtain responses to the worldwide problems of increasing water scarcity, flood risks and environmental pollution.*
4. *Recognise the growing demand for advanced knowledge in water resources and their use in the urban, industrial, and agricultural environment including political and policy aspects of water use.*
5. *Understand the economics involved in water resources management.*

Entry Requirements

Relevant degree

Or

MQF Level 5 qualification and adequate professional experience are also considered.

Key Information

Awarding Body – MCAST

Accreditation Status – Accredited via MCAST's Self Accreditation Process (MCAST holds Self-Accrediting Status as per 1st schedule of Legal Notice 296/2012)

Type of Programme: Qualification

MQF Level	Examples of Qualifications	'Qualification' Minimum Credits Required	'Award' Credits Required
Level 8	Doctoral Degree Third Cycle Bologna Process	NA	NA
Level 7	Masters Second Cycle Bologna Process	90-120	Less than 30
	Post-Graduate Diploma	60	
	Post-Graduate Certificate	30	
Level 6	Bachelor[23]/Bachelor (Hons.)[24] First Cycle Bologna Process	180-240	Less than 180
Level 5	Short Cycle Qualification	120	Less than 60
	Undergraduate Higher Diploma	90	
	Undergraduate Diploma	60	
	Undergraduate Certificate	30	
	VET Level 5 Programme[25]	60-120	
Level 4	Pre-Tertiary Certificate	30	Less than 120
	VET Level 4 Programme[26]	120	
	MATSEC Certificate	NA	
Level 3	VET Level 3 Programme[27]	60	Less than 60
	General and Subject Certificate	NA	
Level 2	VET Level 2 Programme[28]	60	Less than 60
	General and Subject Certificate	NA	
Level 1	VET Level 1 Programme[29]	40	Less than 40
	General and Subject Certificate	NA	
Introductory Level A	Preparatory Programme	30	Less than 30
Introductory Level B	Pre-entry Basic Skills Course	30	Less than 30

Table 1: Minimum number of credits for 'Qualifications' and parameters for 'Awards'

Fig.1: p56, Ministry for Education and Employment & National Commission for Further and Higher Education Malta (2016). *Referencing Report, 4th Edition*. NCFHE.

Total number of Hours: 2250

Mode of attendance: Part Time

Duration: 3 Years

The official language of instruction at MCAST is English. All notes and textbooks are in English (except for language courses which will be in the respective language being instructed). International candidates will be requested to meet English language certification requirements for access to the course.

This course will be offered at

MCAST has four campuses as follows:

MCAST Main Campus
Triq Kordin, Paola, Malta

All courses except for the Institute for the Creative Arts, Centre of Agriculture, Aquatics and Animal Sciences are offered here.

Institute for the Creative Arts
Mosta Campus
Misraħ Għonoq Tarġa Gap,
Mosta

Institute of Applied Sciences,
Centre of Agriculture, Aquatics and Animal Sciences,
Luqa Road, Qormi

Gozo Campus
J.F. De Chambray Street
MCAST, Għajnsielem
Gozo

Teaching, Learning and Assessment

The programmes offered are vocational in nature and entail both theoretical lectures delivered in classes as well as practical elements that are delivered in laboratories, workshops, salons, simulators as the module requirements dictate.

Each module or unit entails a number of in person and/or online contact learning hours that are delivered by the lecturer or tutor directly (See also section 'Total Learning Hours).

Access to all resources is provided to all registered students. These include study resources in paper or electronic format through the Library and Resource Centre as well

as tools, software, equipment and machinery that are provided by the respective institutes depending on the requirements of the course or module.

Students may however be required to provide consumable material for use during practical sessions and projects unless these are explicitly provided by the College.

All Units of study are assessed throughout the academic year through continuous assessment using a variety of assessment tools. Coursework tasks are exclusively based on the Learning Outcomes and Grading Criteria as prescribed in the course specification. The Learning Outcomes and Grading Criteria are communicated to the Student via the coursework documentation.

The method of assessment shall reflect the Level, credit points (ECTS) and the schedule of time-tabled/non-timetabled hours of learning of each study unit. A variety of assessment instruments, not solely Time Constrained Assignments/Exams, are used to gather and interpret evidence of Student competence toward pre-established grading criteria that are aligned to the learning outcomes of each unit of the programme of study.

Grading criteria are assessed through a number of tasks, each task being assigned a number of marks. The number of grading criteria is included in the respective Programme Specification.

The distribution of marks and assessment mode depends on the nature and objectives of the unit in question.

Coursework shall normally be completed during the semester in which the Unit is delivered.

Time-constrained assignments may be held between 8 am and 8 pm during the delivery period of a Unit, or at the end of the semester in which the Unit is completed. The dates are notified and published on the Institute notice boards or through other means of communication.

Certain circumstances (such as but not limited to the Covid 19 pandemic) may lead Institutes and Centres to hold teaching and assessment remotely (online) as per MCAST QA Policy and Standard for Online Teaching, Learning and Assessment (Doc 020) available via link https://www.mcast.edu.mt/college-documents/

The Programme Regulations referenced below apply. (DOC016 available at: link https://www.mcast.edu.mt/college-documents/

Total Learning Hours

The total learning hours required for each unit or module are determined as follows:

Credits (ECTS)	Indicative contact hours	Total Student workload (hrs)	Self-Learning and Assessment Hours
1	5 – 10 hrs	25 hrs	20-15 hrs*
2	10 – 20 hrs	50 hrs	40-30 hrs*
3	15 – 30 hrs	75 hrs	60-45 hrs*
4	20 – 40 hrs	100 hrs	80-60 hrs*
6	30 – 60 hrs	150 Hrs	120-90 hrs*
9	45 – 90 hrs	225 hrs	180-135 hrs*
12	60 – 120 hrs	300 hrs	240-180 hrs*

* The 'Self-Learning and Assessment Hours' amount to the difference between the contact hours and total student workload.

Grading system

All MCAST programmes adopt a learner centred approach through the focus on Learning Outcomes. The assessment of MCAST programmes is criterion-referenced and thus assessors are required to assess learners' evidence against a pre-determined set of Learning Outcomes and assessment criteria.

For a student to be deemed to have successfully passed a unit, a minimum of 50% (grade D) must be achieved. In case of part time programmes, the student must achieve a minimum of 45% to successfully pass the unit.

All units are individually graded as follows:
A* (90-100)
A (80-89)
B (70-79)
C (60-69)

D (50-59)
Unsatisfactory work is graded as 'U'.

Work-based learning units are graded on a Pass/Fail basis only.

Detailed information regarding the grading system may be found in the following document: DOC 016 available at: link https://www.mcast.edu.mt/college-documents/

Intake Dates

•MCAST opens calls for application once a year between July and August of each year for prospective applicants residing in MALTA.
•Applications to full-time courses from international students not residing in MALTA are accepted between April and Mid-August.
•For exact dates re calls for applications please follow this link https://www.mcast.edu.mt/online-applications-2/

Course Fees

MCAST course are free for Maltese and EU candidates. International candidates coming from outside the EU need to pay fees for the respective course. Course fees are set on a per-level and course duration basis. For access to course fee structure and payment methods please visit https://www.mcast.edu.mt/fee-payments-for-non-eu-candidates/.

Method of Application

Applications to full-time courses are received online via the College Management Information System. Candidates can log in using Maltese Electronic ID (eID) or European eIDAS (electronic identification and trust services) to access the system directly and create an account as the identity is verified electronically via these secure services.

Non-EU candidates need to request account creation though an online form by providing proof of identification and basic data. Once the identity is verified and the account is created the candidate may proceed with the online application according to the same instructions applicable to all other candidates.

Non-EU candidates require a study visa in order to travel to Malta and joint the course applied for. For further information re study-visa please access https://www.identitymalta.com/unit/central-visa-unit/.

For access to instructions on how to apply online please visit https://www.mcast.edu.mt/online-applications-2/

Academic qualification leading to a Regulated Profession

Council for Professions Complementary to Medicine
St. Luke's Hospital,
Ex-OPD (Level 1), St. Luke's Square,
Gwardamangia PTA 1010

Contact details for requesting further information about future learning opportunities:

MCAST Career Guidance
Tel: 2398 7135/6
Email: career.guidance@mcast.edu.mt

Current Approved Programme Structure

Unit Code	Unit Title	ECTS
ASWRM-706-1801	Introduction to Water Resource Management	6
ASWRM-706-1802	Climate Change Mitigation and Adaptation	6
ASWRM-706-1803	Environmental Impact Assessment	6
ASWRM-706-1804	Water System Modelling	6
ASWRM-706-1805	Water Biology	6
ASWRM-706-1806	Water Production, Distribution and Harvesting	6
ASWRM-706-1807	Water Technologies	6
ASWRM-706-1808	Water Management	6
ASWRM-706-1809	Water Conservation	6
ASWRM-706-1810	Water Efficiency	6
CDDIS-730-1801	Dissertation	30
	Total ECTS	90

ASWRM-706-1801: Introduction to Water Resource Management

Unit Level (MQF/EQF): 7

Credits: 6

Delivery Mode: Fully Face-to-Face Learning

Total Learning Hours: 150

Unit Description

Water management can be defined as the planned development, distribution and use of water resources in accordance with predetermined objectives while respecting both the quantity and quality of the water resources. It is the specific control of all human interventions concerning surface and ground water. Every planning activity relating to water can be considered as water management in the broadest sense of the term. Many regions of the world are increasingly facing challenges when it comes to managing water. Although all challenges are related to water, the nature of the challenge differs from one location to the next. It may relate to having too little water while water demands are growing explosively (water scarcity), too much water (flooding) and water of poor-quality rendering it unfit to sustain the ecosystem, or the challenges related to providing water for people, industry and agriculture.

What complicates matters further is that these challenges are all interdependent and influence each other. For example, water scarcity can impact water quality and the ability to provide water. Addressing these challenges requires that water managers apply an integrated and interdisciplinary approach, involving hydrological, biophysical, chemical, economic, institutional, legal, policy-making and planning aspects. This unit focuses on scientific analysis of the physical, technical and socio-economic aspects of water management and on the ability to design sustainable and efficient technical solutions to water management problems. In this unit students will develop comparative insight into the development of water management, take a scientific approach to various research paradigms and acquire a problem-oriented, interdisciplinary attitude towards land and water management and rural development issues. The unit addresses issues such as water resource management and the relationship between the hydrological cycle and agriculture. Socio-economic disciplines are integrated with technical aspects.

Learning Outcomes

Upon successful completion of this unit, learners will be able to:

1. *Implement and operate appropriate and sustainable solutions to irrigation and agricultural water management, with due regard to the technical, social and institutional constraints imposed by the surrounding environment;*
2. *Assess crop water needs and plan for sustainable and efficient use of water resources;*
3. *Predict and describe the impacts that human activities could have on the water and environmental resources;*
4. *Explain and argue the principles, concepts and instruments of water resources and desired institutional and management arrangements;*
5. *Model processes of water allocation and use at different scales, and interpret model outcomes in order to understand problems, trends, causes and effects;*
6. *Implement and operate appropriate and sustainable solutions to water management, with due regard to the technical, social and institutional constraints imposed by the surrounding environment;*
7. *Operate and manage pumps, conveyance and application systems;*
8. *Manage and schedule water systems effectively and sustainably.*

ASWRM-706-1802: Climate Change Mitigation and Adaptation

Unit Level (MQF/EQF): 7

Credits: 6

Delivery Mode: Fully Face-to-Face Learning

Total Learning Hours: 150

Unit Description

The unit will provide a full understanding of the climate change agenda from what motivates it, to the processes that have defined it and are still evolving. In addition, students will have hands-on exercises to analyse and evaluate the effects of mitigation options. Special focus will be given to small island states and their problems related to climate change. At the end of the unit, students should have a clear understanding of the complexity of the climate problem and how different mitigation options may contribute to resolving it. This understanding should be demonstrated through the dynamics of exercises and use of diverse tools to help address the problem.

Learning Outcomes

Upon successful completion of this unit, learners will be able to:

1. *Understand the problem of climate change;*
2. *Define the future challenges in climate change;*
3. *Implement the fundamental concepts of adaptation and mitigation;*
4. *Understand the importance of climate change mitigation;*
5. *Analyse and interpret climate change mitigation.*

ASWRM-706-1803: Environmental Impact Assessment

Unit Level (MQF/EQF): 7

Credits: 6

Delivery Mode: Fully Face-to-Face Learning

Total Learning Hours: 150

Unit Description

This unit looks at describing the necessity of an Environmental Impact Assessment (EIA) and defines the base influential parameters of one. Other areas that will be covered include: recognising the main environmental attributes, describing the baseline environment, using adequate prediction and methods of assessment of impacts and introducing public participation in the environmental decision-making process.

Learning Outcomes

Upon successful completion of this unit, learners will be able to:

1. *Understand the basic mechanisms of sustainable development;*
2. *Understand the basic concepts of an environmental impact assessment;*
3. *Define the detailed contents of an environmental impact assessment;*
4. *Recognise the main environmental attributes;*
5. *Describe the baseline environment based on an environmental setting, selected parameters, monitoring of the physical environmental parameters, the 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.*

ASWRM-706-1804: Water System Modelling

Unit Level (MQF/EQF): 7

Credits: 6

Delivery Mode: Fully Face-to-Face Learning

Total Learning Hours: 150

Unit Description

This unit looks at the application of geographic information systems (GIS) to surface water modelling including water in valleys and built-up urban areas especially focusing on the issues of storm water. Regulatory wetland jurisdiction determinations and flood mapping will also be covered. In addition, students will develop spatial computation methods to support hydrological analysis in land use planning, landscape management, and engineering assessments.

Learning Outcomes

Upon successful completion of this unit, learners will be able to:

1. *Create a base map of a study region including water in valleys and built-up urban areas by selecting features from regional maps;*
2. *Interpolate measured data at points to form raster surfaces over a region, and spatially average those surfaces over polygons of interest;*
3. *Conduct hydrologically-related calculations using map algebra on raster grids;*
4. *Analyse a digital elevation model of a land surface terrain to derive water in valleys and built-up urban areas;*
5. *Map a hydrologic region including measurement sites and associate it with a time series of data measured at those locations;*
6. *Develop a hydrologic information system that links a time series of water observations to locations where the measurements have been made;*
7. *Develop spatial maps of the hydrologic impacts of intense precipitation events;*

ASWRM-706-1805: Water Biology

Unit Level (MQF/EQF): 7

Credits: 6

Delivery Mode: Fully Face-to-Face Learning

Total Learning Hours: 150

Unit Description

This unit attempts to cover the basic concepts of the biology of aquatic ecosystems. Students will understand the relationships between the aquatic medium and organisms, taking into account the diverse characteristics of the different aquatic media. The structure and the operation of freshwater and marine ecosystems will be presented focusing on the responses that aquatic ecosystems show to the actual main aquatic environmental problems.

Learning Outcomes

Upon successful completion of this unit, learners will be able to:

1. *Understand the different chemical and physical parameters that affect life in aquatic systems;*
2. *Identify the main primary producers both in freshwater and marine ecosystems;*
3. *Identify the main consumers in both fresh water and marine ecosystem;*
4. *Distinguish the main trophic webs and the organisms responsible for decomposition;*
5. *Identify the main characteristics and processes in different aquatic ecosystems;*
6. *Identify the main human impacts in freshwater and marine ecosystems;*

ASWRM-706-1806: Water Production, Distribution and Harvesting

Unit Level (MQF/EQF): 7

Credits: 6

Delivery Mode: Fully Face-to-Face Learning

Total Learning Hours: 150

Unit Description

This unit attempts to identify suitable fresh water sources for municipal and industrial use, as well as for water harvesting. Learners will be able to construct a flow diagram for the production of potable water and explain the basic principles of a distribution network for drinking water. This unit will also explain the principles of sewer system operation, to meet the current industry standards related to water production, distribution and harvesting, as well as the EU Water Frame Directive.

Learning Outcomes

Upon successful completion of this unit, learners will be able to:

1. *Appraise and discuss suitable fresh water sources for various municipal and industrial applications;*
2. *Evaluate and argue different approaches for rainwater harvesting and assess the quality of this water for specific applications;*
3. *Evaluate several treatment methods for the production of potable water from surface or groundwater sources;*
4. *Formulate and defend a flow diagram for the production of potable water from surface or groundwater sources;*
5. *Describe and discuss the basic principles of a distribution network for potable water through the distribution from a water treatment plant to one or more reservoirs;*

6. *Describe and analyse how a water distribution network and reservoir interact on a daily basis and over a year, and calculate what reservoir volume is required for a given distribution network;*
7. *Explain sewer system operation, including combined and duplicated distribution networks;*
8. *Understand the current standards and rules for the production and distribution of drinking water in the eu, as well as the industry standards for dimensioning distribution networks;*

ASWRM-706-1807: Water Technologies

Unit Level (MQF/EQF): 7

Credits: 6

Delivery Mode: Fully Face-to-Face Learning

Total Learning Hours: 150

Unit Description

This unit covers the engineering principles and practices associated with water technologies, and their application and impact in the context of the full water cycle. Water recycling and purification, water supply and ground water management, wastewater treatment technologies and effluent management are introduced to students in the context of international best practice for the sustainable use of water resources. Students will learn skills for the design of sustainable technologies for liquid waste management, including conventional domestic wastewater treatment plants, advanced reuse technologies (including energy recovery), and product recovery from industrial wastes, and also learn to assess designs using multiple criteria, including cost, effectiveness, energy usage, greenhouse gas emissions, eutrophication potential and water and nutrient cycle impacts.

Learning Outcomes

Upon successful completion of this unit, learners will be able to:

1. *Understand basic water resources and requirements;*
2. *Describe the physical, chemical and biological characteristics of a specific water;*
3. *Conduct an assessment of water technologies for a specific source water and application;*
4. *Interpret the design requirements of a desalination plant;*
5. *Analyse and interpret different water treatment scenarios;*

ASWRM-706-1808: Water Management

Unit Level (MQF/EQF): 7

Credits: 6

Delivery Mode: Fully Face-to-Face Learning

Total Learning Hours: 150

Unit Description

This unit covers the context and principles of water management from catchment to consumer; structural and hydraulic components of water distribution systems (reservoirs, pump stations, surge tanks) and water/wastewater collection systems (manholes, combined sewer overflows, siphons, pumping stations, attenuation tanks). Special focus will be given to the regulatory aspects of water management and water framework directives.

Learning Outcomes

Upon successful completion of this unit, learners will be able to:

1. *Describe in broad terms the history and current context and trends in water management;*
2. *Identify the regulatory aspects of water management and the water framework directive;*
3. *Identify and describe the components of water distribution systems and surface/wastewater collection systems;*
4. *Compare the available pipeline construction methods and techniques;*
5. *Develop simple numerical analysis tools for hydraulic systems, units and structures;*
6. *Analyse and design water storage and distribution systems, surface water collection and attenuation systems, incorporating sustainable urban drainage systems as well as wastewater collection systems;*

7. *Design hydraulic structures at water and wastewater treatment plants and develop hydraulic profiles through plants;*
8. *Evaluate the economics of water distribution and collection systems;*

ASWRM-706-1809: Water Conservation

Unit Level (MQF/EQF): 7

Credits: 6

Delivery Mode: Fully Face-to-Face Learning

Total Learning Hours: 150

Unit Description

Water conservation is a distinct and unique branch of environmental studies. Its development has also been stimulated, of course, by a wide range of applications of theories of rainfall and runoff, water harvesting, water composition with respect to crop development, facilities for water desalinisation, dams and farm ponds as well-structured practical classes required for water conservation. It is essential that students understand water systems, and the strategies to mitigate or manage these issues.

Learning Outcomes

Upon successful completion of this unit, learners will be able to:

1. *Understand the terminologies used in water conservation;*
2. *Evaluate information using scientific principles, and synthesise reports/articles discussing water conservation issues;*
3. *Summarise and describe landscape scale environmental systems and processes;*
4. *Understand and interpret the problems caused by poor management in water conservation;*
5. *Analyse water conservation problems, and develop the methods to solve water conservation management and conservation problems.*

ASWRM-706-1810: Water Efficiency

Unit Level (MQF/EQF): 7

Credits: 6

Delivery Mode: Fully Face-to-Face Learning

Total Learning Hours: 150

Unit Description

This unit aims to introduce students to the basic principles of the functioning, design, management and maintenance of a water supply system. In particular, design methodologies and criteria of management and maintenance and control will be analysed in the unit, which allows for an increase in the efficiency of water networks while reducing water (e.g., leakages) and energy consumption and extending technical life. In addition, this unit will provide basic knowledge of water metering and measurement as well as explain how to perform the laboratory measurements required to guarantee safe drinking water.

Learning Outcomes

Upon successful completion of this unit, learners will be able to:

1. *Understand the hydraulics of steady-state pressure pipe flow and pressure pipe systems, including the hydraulics of pumps and pumping stations;*
2. *Perform population projection and water demand characterisation for a water supply system and select the proper source(s) and its capacity to supply potable water;*
3. *Determine the main planning elements of these systems, namely designing demands, pressures, velocities and gradients;*
4. *Understand the basic principles of water metering and measurement;*
5. *Choose adequate supplying schemes, design a looped network layout, the main components such as reservoirs and pumping stations and pipe materials;*
6. *Perform a water network hydraulic analysis to ensure the flow rate and pressure requirements are met;*
7. *Identify and design technical solutions dealing with system maintenance, leakage reduction, energy consumption reduction, rehabilitation, and expansion.*