Master of Water Resources Engineering

I. Introduction

Al-Quds University has a distinguished e-Master's program in Water Resources Engineering that aims at serving the community in the field of natural resources management. The university plays a pivotal role in achieving the objectives of sustainable development by promoting the transfer of knowledge and experiences of others. The program is designed to cater to local and regional needs and provides vital data and information that can support sustainable planning and development.

In addition to its educational mission, Al-Quds University is committed to conducting research that is connected with the needs of the community. The Department of Applied Earth and Environmental Sciences/Faculty of Science and Technology supervises the program, in collaboration with other departments in the faculty such as the Department of Life Sciences, Department of Chemistry, and Department of Physics. The program is designed to support the goals of the Ministry of Higher Education and to enhance and support such programs.

By establishing an e-Master's program in Water Resources Engineering, Al-Quds University can contribute significantly to the general strategy of the university and support the goals of the Ministry of Higher Education. This program will not only provide students with the flexibility of learning from anywhere but also ensure that they have access to the latest knowledge and techniques in the field of water resources engineering.

II. Objectives

The Master's program in Water Resources Engineering has been designed to achieve the following goals:

1. To equip engineers and scientists with the necessary technical knowledge, managerial skills, research capabilities, and problem-solving skills to address various challenges and issues in the field of Water Resources Engineering. This program will enable students to make informed decisions and contribute significantly to their respective fields.
2. To contribute to the development of the Palestinian community and promote global knowledge and research advancement. The program aims to establish productive research and teaching collaborations with other national and international higher education institutions, ultimately fostering continuous improvement, experience sharing, and attracting international students.

By achieving these objectives, the program will help develop skilled professionals and enhance the reputation of the university.

III. Rational

The e-Master's program in Water Resources Engineering is a two-year graduate program that relies on e-learning with a 50% ratio of long-distance learning. Its aim is to update education using innovative technology and advanced tools to provide more sustainable solutions to water scarcity problems in the Middle East and North Africa region. The program includes case study programs on various topics under the supervision of local and international experts and is open to several types of participants: university graduates, general administrators in the field of water and environmental resources, and employees of many related ministries.
There will be opportunities for students to travel to partner countries through student exchange programs to study at least one academic semester, and teaching points will be equaled and calculated according to applicable rules and regulations.

IV. Facilities *

Laboratories are very good equipped for water and environmental research. Computer Laboratory can be used for data analysis and water modeling. The library of the Faculty of Science and Technology includes a very good collection of modern and specialized books in the fields of environmental and water science. Furthermore, an access to electronic scientific journal is possible (Springer and Elsevier Publisher and On-Line Turento Library) for students and researchers.

V. Admission Requirements *

Admission to the master program in water and environmental studies requires the following:

1. B.Sc. degree in natural sciences (earth sciences, chemistry, biology agriculture, civil engineering, physics, ecology) with a minimum of good average (according to the grading system of the candidate's original university).
2. Completion of 3 credit hours in Introduction to Computer Science. *Students may be admitted on conditional bases of completing the required undergraduate courses*
3. Two letters of recommendation from previous professors/or latest employer
4. Passing the personality assessment on the bases of interview conducted by the graduate admission committee

VI. Degree Requirements

a. For the Thesis Track

The master degree in water and Environmental Sciences Studies will be awarded by Al-Quds University upon the student's completion of 36 credit hours distributed as follows:

1. Obligatory courses (27 credit hours):
All of course work must be completed:

Course #	Course Name	Course name in Arabic	Credit Hours
8130610	Research methodology	أساليب البحث	2
8130615	Stochastic hydrology	الهيدرولوجيا العشوائية	2
8130603	Groundwater hydrology and modeling	نمذجة هيدرولوجيا المياه الجوفية	3
8130617	Integral project (Desalination, Artificial recharge, Wastewater reuse, SMART agriculture, etc.)	مشروع تطبيقي مدمج	3
8130605	Water governance, water diplomacy and conflict management	دبلوماسية المياه وإدارة الصراع	2
8130618	Advanced water treatment technology	تكنولوجيا معالجة المياه المتقدمة	3
8130620	Remote sensing and GIS application in water resources engineering	الاستشعار عن بعد ونظم المعلومات الجغرافية في إدارة هندسة موارد المياه	3
8130608	Integrated water resources management	إدارة موارد المياه المتكاملة	3
8130600	Thesis	الرسالة	6
		Total	**27**

2. Elective Courses (9 credit hours):
Can be chosen from the courses below*:

Course #	Course Name	Course name in Arabic	Credit Hours
8130609	Environmental programming	البرمجة البيئية	3
8130613	Surface hydrology and modeling	الهيدرولوجيا السطحية	3
8130611	Environmental & social impact assessment	تقييم الأثر البيئي والاجتماعي	3
8130612	Advanced numerical methods	النمذجة العددية المتقدمة	3
8130614	Water quality	جودة المياه	٣ 2
8130602	Climate change and water sustainability	التغير المناخي واستدامة المياه	٣ 2
8130604	Water-energy-food nexus	العلاقة المدمجة للمياه والطاقة والغذاء	3
8130606	Entrepreneurship and innovation in water	ريادة الأعمال والابتكار في مجال المياه	3
8130607	Water harvesting	الحصاد المائي	3
8130619	Coastal engineering and management	إدارة وهندسة السواحل	3
8130622	Water accounting	المحاسبة والشفافية	3
		Total credit hours for courses	9

3. Thesis Research (6 credit hours) (included in the table above)

4. Thesis presentation and defense based on research work will be evaluated by the advisory committee. Thesis defense will be through an oral presentation and discussion session with the advisory committee.

b. For the Comprehensive Exam Track

1. Obligatory courses (24 credit hours): *

Course #	Course Name	Course name in Arabic	Credit Hours

8130610	Research methodology	أساليب البحث	2
8130615	Stochastic hydrology	الهيدرولوجيا العشوائية	2
8130603	Groundwater hydrology and modeling	هيدرولوجيا المياه الجوفية	3
8130617	Integral project (Desalination, Artificial recharge, Wastewater reuse, SMART agriculture, etc.)	مشروع تطبيقي مدمج	3
8130605	Water governance, water diplomacy and conflict management	دبلوماسية المياه وإدارة الصراع	2
8130618	Advanced water treatment technology	تكنولوجيا معالجة المياه المتقدمة	3
8130620	Remote sensing and GIS application in water resources engineering	الاستشعار عن بعد ونظم المعلومات الجغرافية في إدارة هندسة موارد المياه	3
8130608	Integrated water resources management	إدارة موارد المياه المتكاملة	3
8130623	Graduation Project	مشروع التخرج	3
		Total	**24**

2. Elective Courses (12 credit hours):
Can be chosen from the courses below :

Course #	Course Name	Course name in Arabic	Credit Hours
8130609	Environmental programming	البرمجة البيئية	3
8130613	Surface hydrology and modeling	الهيدرولوجيا السطحية	3
8130611	Environmental & social impact assessment	تقييم الأثر البيئي والاجتماعي	3
8130612	Advanced numerical methods	النمذجة العددية المتقدمة	3
8130614	Water quality	جودة المياه	٢ 3
8130602	Climate change and water sustainability	التغير المناخي واستدامة المياه	٣2
8130604	Water-energy-food nexus	العلاقة المدمجة للمياه والطاقة والغذاء	3
8130606	Entrepreneurship and innovation in water	ريادة الأعمال والابتكار في مجال المياه	3
8130607	Water harvesting	الحصاد المائي	3
8130619	Coastal engineering and management	إدارة و هندسة السواحل	3
8130622	Water accounting	المحاسبة والشفافية	3
		Total credit hours for courses	12

3. Graduation Project (3 credit hours)
The student should prepare and submit a written report under the supervision of one of the staff members of the faculty and defense it in an open session. The work should be finished within one semester.

4. Comprehensive Exam:
After completing the courses successfully, including the graduation written project. The student should pass a comprehensive exam according to rules and regulation of the University.

VII. Advisory committee (For the Thesis track only)
Upon admission to the program, an academic advisor will be appointed to guide the student throughout the whole program. Once the student completes the practical research work, a committee of 3 scientists (in addition to his or her academic advisor) will be appointed to review and evaluate his or here thesis. One member of the committee should be an outside reader. An observer from the Dean's Office of Graduate Studies must be present during the thesis defense.

All courses for master program " **Water Resources Engineering**"

8130602 Climate Change and Water Sustainability	**3 credit Hours**

The course investigates how climate change and sustainable development are linked, and how both are combined in local, national, regional and international policy-making about environment and development challenges such as poverty, global inequalities, loss of biodiversity, and the deterioration of global ecosystems.
The course includes the general concepts of climate-driven parameters, and climate change throughout the history of the earth, and the impact of climate change on life development in water and terrestrial. The course also discusses the roles of industrial revaluation and increase the immersion of greenhouse gasses on climate change. The main purpose of the course is to examine the ways in which state, private sector, and civil society interact on national and international levels to address climate change and sustainable development issues through better policymaking and governance models and frameworks of sustainability.

8130603 Groundwater Hydrology and Modelling	**3 credit Hours**

The goal of this course is to give the student a fundamental understanding of the principles and practical applications of groundwater occurrence and behavior, such that the student will be able to interpret observations in a correct way, calculate and predict groundwater amounts and movement, design groundwater and in general be able to manage groundwater in a safe and sustainable way. Furthermore, to teach the students how to use professional software for simulation and prediction of groundwater flow and pollutant transport, so that they are able to analyze and solve groundwater problems that they will encounter in their professional career. In addition, the students should be able to transform the field data into model inputs.

8130604 Water energy food nexus	**3 credit Hours**

This course introduce the knowledge of nexus, and the link between water-energy-food. Understand the use of alternative energy to improve water resources in term of quantity and quality, use of alternative energy in improving food production (heating and cooling). The course offer students how to calculate water-, energy and carbon footprint in agricultural crops (using life cycle assessment). The course will provide student skills of how to use water-energy sources in proper way in producing food. In addition, it discusses the environmental impacts of renewable energy on reducing carbon dioxide emission, and the consequences on climate change.

8130605 Water governance, conflict management, and diplomacy	**2 credit Hours**

The course introduces students to the concept of water governance framework at different levels (local, regional, national, trans-boundary basin). Students will be exposed to the terms " sustainable development, water management, water rights, and equity".
The course also will expose students to the important of water for health, economic development, environmental natural resources, and well-being commodity. They also introduce to human water need, water- shortage, and scarcity. Water could be also as source of cooperation, or source of conflict at different levels "local, national, basin, and cross the borders".
The course will provide students concepts of possible water cooperation, and also provide them with theoretical knowledge, tools and skills to engage in preventing water conflict.

8130606 Entrepreneurship and innovation in water	**3 credit Hours**

The course includes the general concepts to identify the value chain of water products (Software, hardware). The student will expose to knowledge of how to identify, collect relevant data, and integrate professional skills to handle complex concept water products. The course also discusses how to establish a startup, perform, analyze the company environment, design appropriate strategy, and how to test new products, and how to predict market response. The main objective of this course is to promote

entrepreneurship among those interested in water security and their innovation and provide the basic tools to manage it.

8130607 Water harvesting (WH)	3 credit Hours

Limited knowledge about WH-technique is available in the West Bank, and only WH is limited to roof WH, and this sources of water is still not utilize. The course aim to introduce differ WH-methods in micro and macro catchment area., this include how to select appropriate site, techniques, how to design rainwater /surface harvesting at field, in a farm level, predict effect of WH on downstream, how to calculate cost/benefit analysis, revenue and profit under different net present value conditions, and what is the socio economic aspects by adaptation of WH.

8130608 Integrated Water Resource Management	3 credit Hours

This course introduces water sources in semi-arid, arid regions, and challenges facing the water sector. It discusses methods of sustainability and management theories. The course includes the effect of increasing water demand in different sectors on the availability, quality of sources.
Special attention will give to the economic, environmental impact of the integration concept. It analyzes the interrelations among water sources, water uses, and the importance of water sustainability. The course offer student to learn how GIS-technique and relevant software can apply in managing water sources. The goal of this course is to understand the importance of sustainable water management for the water security and socio-economic development of the region.

8130609 Environmental Programming	3 credit Hours

Programming is essential skills for engineers because it allows to manipulate and analyze large dataset in an automated way, and understand numerical models and modify them to specific needs. Python is an open-source, general-purpose, high-level interpreted computer language that has become one of the most popular in the last decades. Python relies on its large user community for developments and "has arguably become the de facto standard for exploratory, interactive, and computation-driven scientific research.
This course introduces the basic concepts of programming and lays a solid foundation in environmental modeling using Python with examples from the water engineering real-world issues.

8130610 Research Methodology	3 credit Hours

This course aims to provide the students with the necessary knowledge and skills to conduct solid scientific research in the Water Resources Engineering field and disseminate their work and findings in a professional and ethical manner. The course will particularly focus on enhancing the students' written and oral communication skills by addressing the different technical writing styles in order to prepare technical reports, theses and dissertations, research papers, and presentations. Moreover, the students will be familiarized with the research publication process and guidelines in order to publish their future research work in reputable peer-reviewed journals.

8130611 Environmental and Social Impacts Assessment - ESIA	3 credit Hours

The course is designed to provide a critical overview of the theory and practice of ESIA for postgraduate students, plus practitioners/professionals. The aim of the course is to provide an understanding of ESIA and confidence in its application and limitations.

8130612 Advanced numerical methods	3 credit Hours

This course will provide the students with the necessary tools and methods to find numerical solutions to various Water Resources Engineering problems and models. Students will be introduced to different numerical methods for solving a system of linear and nonlinear equations, curve fitting, ordinary differential equations, partial differential equations, integration, and optimization. Students will

thoroughly utilize computer software throughout this course to perform the numerical analysis and modeling.

8130613 Surface Hydrology and Modeling	**3 credit Hours**

This course emphasizes engineering applications of hydrologic science. The following topics will be covered in the course: Introduction to hydrology, watershed delineation, hydrologic cycle, precipitation, rainfall loss, evaporation and transpiration, infiltration, stream flow and watershed characteristics, hydrograph characteristics and time parameter, unit hydrograph analysis, synthetic hydrograph, flood routing analysis, advanced topics on flood routing, urban hydrology and stormwater management, statistical methods in hydrology, and introduction to and application of HEC-HMS.

8130614 Water quality	**2٣ credit Hours**

This course aims as introducing the physical, chemical, and biological dimensions of the water quality, and the natural as well as the anthropogenic factors/processes affecting them. Special emphasis will be given to water pollution in terms of composition, sources, fate, control and remediation. Environmental isotopes as an effective tool for water scientist working in arid and semi-arid regions will be exploited. Water quality regulations will be presented. Planning and setting up water quality monitoring and assessment programs will be introduced. Students will be able to display, characterize, interpret, and model water quality data, using different methods and techniques such as statistical, GIS, and specialized software. They will be able to build up water quality indices. They will be also able to apply isotopic methods in water quality management.

8130615 Stochastic Hydrology	**3 credit Hours**

The course aims to introduce statistical methods used for hydrological design, probability and statistics applied to the solution of hydrological problems, some standard time series analysis methods of hydrologic data, some stochastic models used for the rainfall input to hydrological systems, and extreme event frequency analysis.

8130617 Integrated Project (Desalination, Artificial recharge, Wastewater reuse, SMART agriculture, etc.)	**3 credit Hours**

The structure of the project is given, the objectives and the way of assessment. An introduction to the geographical, hydrological and water management characteristics of the catchment is given. The need and requirements for an integrated river basin management plan are described.
The main objective of the "Integrated Project: Semi-arid climate case study" is to expose the students to the execution of an integrated project and to obtain in this process technical expertise in (semi)-arid river basin modeling. The goal is to increase the students' understanding of the web of interactions between the different technical and non-technical relations in managing water resources on an integrated river basin scale. An important aspect will be the integration of irrigation systems into the overall basin management.

8130618 Advanced water treatment technology	**3 credit Hours**

This course will cover a wide spectrum of advanced topics on water treatment technologies including an overview of the conventional water treatment processes and systems, the need for advanced water treatment technologies, reactor analysis and mixing, principles of mass transfer, chemical oxidation and reduction, membrane filtration, disinfection, adsorption, ion exchange, advanced oxidation, reverse osmosis, removal of selected constituents, and residuals management.

8130619 Coastal Engineering and Management	**3 credit Hours**

Coastal engineering and management involve a range of disciplines related to the interaction of the sea with the land.

At the end of the course, the student will learn the main aspects of the coastal zone, be able to identify threats to coastal resources associated with human activities, and understand planning and decision making with reference to water and coastal management. The course includes a local field visit.

8130620 Remote Sensing and GIS Applications in water resources engineering	3 credit Hours

The course is divided into two modules: (1) GIS for hydrological applications, and (2) Remote Sensing for Water Management.
(1) GIS for hydrological applications
The course introduces the basic concepts of GIS using open-source software (QGIS) in a problem-based learning approach that is centered around the acquisition and (pre)processing of data for hydrological applications.
(2) RS for water resources management
Remote sensing (RS) technology is widely used to monitor natural resources and human development, As RS is increasingly used in the field of water resources, it is important for water professionals to understand both its strengths and limitations, In this course, students will learn the basics of remote sensing and which data you can use for water resources applications as well as how to carry out a basic water assessment using remote sensing datasets.

8130622 Water accounting	3 credit Hours

Water Accounting is a relatively new tool that is designed to support the decision-making process in water resources management. It is often defined as "the systematic quantitative assessment of the status and trends in water supply, demand, distribution, accessibility and in specific domains."[1] Many water accounting frameworks exist and the use of these frameworks is becoming more and more common. In this course, we will cover the basic concepts of the internationally recognized water accounting frameworks but also the state-of-the-art developments in the field of water accounting such as the water accounting plus framework (WA+) that make use of remote sensing data as the main source of information.

8130623 Graduation Project	3 credit Hours

The student should prepare and submit a written report under the supervision of one of the staff members of the faculty and defense it in an open session. The work should be finished within one semester.

8130600 Thesis	6 credit Hours

The master's thesis is the final proof of the ability of the student to independently handle more complex problems within the area of water resources engineering, and to work as a "scientific engineer" on an advanced level. With your mentor / supervisor, the student can discuss available subjects for your thesis research.

Internship	0 credit Hours

The internship offers workplace training and experiences that relate to the student's general and technical course of study in preparation for work in the water resources field, including aspects of the duties, skills, and functions of the hosting entity. The internship will allow student to develop his/her professional skills, gain hands-on experience, evaluate career opportunities and begin building a professional network. Moreover, internships provide learning experiences not available in the classroom setting; and offer entry-level, career-related experience and workplace competencies that employer's value when hiring new employees.

COURSE SEQUENCE: FOR THESIS TRACK

First Year

Fall semester		
Course Name	**No.**	**Credits**
Research methodology	8130610	2
Integrated water resource management	8130608	3
Elective Course	*******	3
Spring semester		
Stochastic hydrology	8130615	2
Advanced water treatment technology	8130618	3
Groundwater hydrology and Modelling	8130603	3
	Total	**16**

Second Year

Fall semester		
Course Name	**No.**	**Credits**
Integral project (Desalination, Artificial recharge, Wastewater reuse, SMART agriculture, etc.)	8130617	3
Water governance, water diplomacy and conflict management	8130605	2
Elective Courses	*******	3
Spring semester		
Remote sensing and GIS application in water resources engineering	8130620	3
Elective Courses	*******	3
Thesis	8130600	6
	Total	**1820**

COURSE SEQUENCE: FOR COMPREHENSIVE EXAM TRACK

First Year

Fall semester		
Course Name	**No.**	**Credits**
Research methodology	8130610	2
Integrated water resources management	8130608	3
Elective Course	*******	3
Spring semester		
Stochastic hydrology	8130615	2
Advanced water treatment technology	8130618	3
Elective Courses	*******	3
	Total	**16**

Second Year

Fall semester		
Course Name	**No.**	**Credits**
Remote sensing and GIS application in water resources engineering	8130620	3
Water governance, water diplomacy and conflict management	8130605	2
Elective Courses	*******	3
Groundwater hydrology and modeling	8130603	3
Spring semester		
Integral project (Desalination, Artificial recharge, Wastewater reuse, SMART agriculture, etc.)	8130617	3
Elective Courses	*******	3
Graduation Project	8130623	3
	Total	**20**