



The University of Jordan

Faculty of Marine Sciences

Department of Coastal Environment

**Masters' Program
in Marine Science**

2014/2013

Study Plan

Masters Degree in Marine Science

(Thesis Track)

Introduction

The Faculty of Marine Sciences (FMS) at The University of Jordan-Aqaba Branch provides multidisciplinary programs contributing to the national, regional, and international goals for education and scientific research in marine sciences. The projected plan for the faculty is to establish four different B.Sc. programs, with degrees awarded by the departments of: Marine Biology, Coastal Environment, Marine Navigation, and Marine Resources. The Present stage is focused on the establishment of a B.Sc. program in the departments of: Marine Biology, and Coastal Environment, in addition to initiating a **Masters Degree (M.Sc.) Program in Marine Sciences**. Followed by initiating other masters degree programs such as Marine Biotechnology and Pharmaceutical Bioactive Material in the near future.

These programs were designed to provide students with the essential knowledge in marine sciences and get them ready to fulfill the demand for trained personnel in educational, environmental, and industrial sectors in need for qualified staff in various marine related fields of expertise.

Objectives

The Master Program of Marine Sciences in the FMS is designed to provide its graduates with the knowledge and skills that makes them competent in the various marine fields. Graduating students shall be successfully qualified to compete and play an important role in marine-related technical/academic positions in industry, government and education sectors and ready to join graduate studies Ph.D. programs in the marine related fields of studies.

This program is streamlined with practical experience and hands-on application in mind, provided to our students through the thesis track, under the mentorship of the FMS staff specialized in different marine sciences fields. The staff at the FMS are currently working on marine related research/teaching topics capable of achieve better understanding of the marine environments, leading to an efficient conservation of its valuable resources and better maintenance of marine ecosystems balance. Research topics cover, but not restricted to, physical, geological, chemical, and biological oceanography, as well as specialized research in marine paleoclimatology, aquaculture, biology and ecology of benthic and pelagic marine organisms, in addition to the newly established marine microbiology and molecular biology research components.

Due to the interdisciplinary nature of modern marine sciences, both departments: Marine Biology and Coastal Environment will be jointly supporting this MSc program in Marine Sciences.

Currently, the local and international market is desperately demanding expertise in aquaculture, marine technical development, monitoring programs, coastal and fisheries management. This innovative MSc program in Marine Sciences will enhance student's work and career progression by providing a wealth of knowledge with real field-applications. Students are expected to develop skills that are essential to the sustainable management of marine ecosystems and resources. A modern marine scientist shall thus be trained in biological, physical and chemical and geological oceanography in addition to other related fields makes their capacities vital for science-based open-ocean and coastal zone management.

Goals

Through the Masters Program in Marine Sciences, the FMS is striving to achieve the following goals:

1. Rehabilitate admitted students in the MSc program and acquaint them with the necessary scientific background in the field, and graduate them as qualified and capable personnel, experienced in marine sciences topics relevant to hiring institutions' needs at the national, regional, and international levels.
2. Provide the opportunity for the MSc enrolled in the program to conduct hands-on research their field of interest in marine sciences, which will be the topic of their thesis research needed to obtain the MSc degree.
3. Using state-of-the-art teaching and scientific methodologies in delivering the program components to the students enrolled in the MSc program.
4. Contribute to favor the public and private sector with specialized and trained cadres capable of enhancing their work place with the finest products.
5. Paying special attention to studies tackling environmental challenges and providing appropriate solutions for the current and future times.
6. Prepare scientifically and technically well-qualified and trained graduates capable of actively contributing to the success of national and international development programs.
7. Provide scientific and technical services and consultations to educational institutions interested in marine environment studies.
8. Provide hands-on-training to students and refine their abilities to properly utilizing marine resources and efficiently performing applied research in marine sciences.
9. The program will help establishing scientific references and long-term databases relevant to marine sciences in the region.
10. Contribute to marine environmental awareness programs and cooperation with institutions and bodies interested in marine environment protection and conservation.

Human resources and logistics capability of the FMS

First – Human resources

The FMS has two departments the teaching of marine sciences where these departments are based on a selection of full-time professors, lecturers, technicians.

No.	Name	Rank	Qualification	Specialization	Department

1	Prof. Dr. Ahamd Abu-Hilal (Dean of FMS)	Professor	Ph.D.	Chemical Oceanography	Coastal Environment
2	Prof. Dr. Tariq Al-Najjar (chair of Marine Biology department)	Professor	Ph.D.	Marine Biology/Planktology	Marine Biology
3	Dr. Fuad Al-Horani (chair of Coastal Environment department)	Associate Prof.	Ph.D.	Marine Biology and Ecology	Marine Biology
4	Dr. Maroof Khalaf	Associate Prof.	Ph.D.	Zoology/Fish biology	Marine Biology
5	Dr. Mohammad Al-Zibdeh	Associate Prof.	Ph.D.	Fishery and Aquaculture	Marine Biology
6	Dr. Riyad Manasrah	Associate Prof.	Ph.D.	Physical Oceanography	Coastal Environment
7	Dr. Mohammad Rasheed	Associate Prof.	Ph.D.	Chemical Oceanography	Coastal Environment
8	Dr. Saber Al-Rousan	Associate Prof.	Ph.D.	Marine Geology	Coastal Environment
9	Dr. Mamoon Al-Rshaidat	Assistant Prof.	Ph.D.	Molecular Microbial Ecology	Coastal Environment
10	Mahmood Abu-Al-Hayjaa	Fellow (Ph.D.)	M.Sc.	Coastal Management	Coastal Environment
11	Moayed Al-Hasanat	Fellow (Ph.D.)	M.Sc.	Marine Geophysics	Coastal Environment
12	Zainb Arabeyat	Fellow (Ph.D.)	M.Sc.	Marine Biotechnology	Marine Biology
13	Wesam Al-Hayek	Fellow (Ph.D.)	M.Sc.	Marine Economy	Coastal Environment
14	Majdoleen Subehat	Lecturer	M.Sc.	General Biology	Marine Biology
15	Rana Al-Momani	Lecturer	M.Sc.	Organic Chemistry	Coastal Environment
16	Eman Al-Absi	Lecturer	M.Sc.	Applied Physical	Coastal Environment
17	Amerah Al-Reyaty	Lab supervisor	M.Sc.	General Biology	Marine Biology
18	Laila Saada	Lab Technician	B.Sc.	General Biology	Marine Biology
19	Eman Saleem	Lab Technician	B.Sc.	General Chemistry	Coastal Environment
20	Khalid Trabeen	Lab Technician	B.Sc.	Marine Sciences	Marine Science Station (MSS)
21	Omar Al-Momani	Lab Technician	B.Sc.	Applied Biology	MSS
22	Maysara Al-Amor	Lab Technician	Diploma	Electronics	MSS

Second – Lecture rooms

Lecture rooms of various capacities (50-90 students/room) are available in the FMS. All equipped with data show equipment and other educational resources to help the educational process. In addition, lecture rooms at the Marine Science Station (MSS) are also available.

Third – laboratories

FMS has five specialized teaching laboratories fully equipped for teaching purposes as follows:

- 1- Teaching labs for the different biology courses: **two labs**.
- 2- Teaching lab for the different chemistry courses.
- 3- Specialized lab for teaching molecular biology and microbiology. This lab is currently under furnishing with different equipment.
- 4- Teaching lab for geology and physics courses.

In addition, the FMS has also computer laboratory and another laboratory for teaching theoretical and practical part of the GIS. Both labs are fully equipped with adequate and up-to-date tools, software and computers to serve the education process.

Fourth – Research laboratories

FMS has several research laboratories, located at the MSS, which are open for faculty, researchers, and students of the FMS. These laboratories are also open to visiting researchers and students coming from national and international universities and scientific institutions. These laboratories include:

- 1- Coral Eco-Physiology lab
- 2- Fish biology and ecology lab
- 3- Benthos and plankton lab
- 4- Chemistry lab
- 5- Physical Oceanography lab
- 6- Aquaculture unit
- 7- Wet lab
- 8- Instrumentation lab
- 9- Marine geology lab
- 10- Molecular Microbial Ecology lab (MMELA)

All labs are equipped with adequate and up-to-date instruments and equipment to serve the FMS students for conducting their research projects in the various fields of marine sciences.

In addition, research logistic support is provided by the MSS, that will be used for the purposes of training, scientific research, and field work such as: SCUBA diving unit, boats unit, and marine aquarium.

Fifth – Research boats and field work

The student will be able to make use of the research boats and supported onboard equipment, and conducting practical research fieldwork. Students are exposed to technical, operational and legal aspects of sea-going research operations; and learn the process of planning and executing field research operations; in addition to hands on training that includes techniques and equipments regularly practiced and used onboard research boats and ships, including getting students familiarized with data acquisition, sampling, laboratory procedures, and analysis.

Sixth – Scientific Research Laboratories: Training before conducting M.Sc. project

FMS will provide students admitted to the MSc program the chance to use the available scientific research laboratories at the FMS and MSS before embarking on the MSc research project.

Each new student is required to spend three months of practical research laboratory rotation during the first year of the program. The three months are equally divided into three periods, one month per each rotation, where the student will select three different research laboratories in the college of marine sciences of his preference taking into consideration the special conditions for the research specialty area. During each laboratory rotation, the student will conduct a short research project to familiarize him/her-self with the research done in the corresponding research laboratory. At the end of each rotation, the student is required to submit a written report of his research work. In addition the student shall present his/her research. After the three months rotation, and based on the knowledge acquired during the rotation period, the student will select the research field where he/she wants to complete his/her masters thesis research.

Seventh – Diving Unit

The FMS and the MSS are furnished with all the required supplies, tools and equipment needed for training graduate students in this program for SCUBA and scientific diving, including training on ecological surveying and sampling methods. A dive instructor assistant and other specialized and qualified divers are available in the FMS and the MSS for all needed training.

Study Plan

First – Required facilities

All the facilities and infrastructure that are required for the success implementation of the program are available at the FMS and the MSS.

Other research and teaching apparatus, instrumentation, supplies and consumables and chemicals can be included within the plans and budget of the FMS.

In addition, the FMS will put into action the memorandums of understanding signed with other universities and scientific institutions specialized in marine research from America and Europe for the benefit of the program and the students.

Second –Expected admitted students

Admitted students are expected to be from the FMS undergraduates, graduation from the FMS in the academic year 2013/2014, as well as students graduating from Jordanian universities in the disciplines of chemistry, physics, geology, biology, environment and students from several disciplines of agricultural sciences. It is also expected for this program to attract students from Arabian Gulf countries, especially from Kuwait, Bahrain, Saudi Arabia, Oman, and Yemen. The expected number of MSc program admitted students for the first three years will be 15 to 20 students.

Third –Courses

The courses of the MSc program consist of (33) credit hours, including (9) credit hours of masters' thesis, divided as follows:

Credit Hours	Requisite	Courses	Notes
15	Basic course work	Biological Oceanography Chemical Oceanography Geological Oceanography Physical Oceanography Research Methods	
9	Elective	Selected from the list of elective courses.	Each course is equivalent to 3 credit hours.
9	MSc thesis		
33	Total		

Departments' codes

Number	Department	Field code	Specialization address
01	Marine Biology	0	General Ecology
02	Coastal Environment	1	Marine Biology
		2	Physics
		3	Chemistry
		4	Geology
		5	Mathematics

Study Plan

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General Rules and conditions

1. This plan conforms to the valid regulations of the programs of graduate studies.
2. This plan conforms to the regulations for awarding M.Sc. degree at the University of Jordan.
3. Disciplines that can be accepted in this program:
 1. Group I:
 - B.Sc. in chemistry.
 - B.Sc. in life Sciences (biology).
 - B.Sc. in geology.
 - B.Sc. in Physics.
 - B.Sc. in the environmental.
 2. Group II: B.Sc. in Marine Sciences (physical, chemical, geological and biological) and B.Sc. in Marine Sciences (coastal environment, marine biology).
 3. Group III: B.Sc. in (civil engineering, environmental engineering, chemical engineering and geological engineering).
 4. Group D: B.Sc. in all disciplines of the Faculty of Agriculture.

Special Conditions

- Teaching in the program is in English.
- Scientific research committee will determine the admitted students' needs for any prerequisite courses.
- Student's English language proficiency will be evaluated according to The University of Jordan English proficiency requirements.
- FMS offers the thesis-based MSc in Marine Sciences track, while students are required to complete at least 24 credit hours from the list of courses offered by the FMS, in addition to thesis equivalent to 9 credit hours.
- Before a student embarks on thesis research, one thesis supervisor or more should be formed for each student. The student is required to submit a thesis proposal presented to scientific research committee of the faculty attended by student to be accepted after discussion.

1. Basic obligatory courses (15) credit hours distributed as follows:

The courses of the MSc program consist of (33) credit hours, including (9) credit hours of masters' thesis, divided as follows:

Course No.	Course Name	Credits	Pre-request
5501711	Biological Oceanography	3	--
5502721	Physical Oceanography	3	--
5502731	Chemical Oceanography	3	--
5502741	Geological Oceanography	3	--
5502751	Research Methods	3	--

The student is allowed to take 3 credit hours from the elective courses instead of the obligatory courses after the approval of Curriculum Committee in the Department.

2. Elective courses (9) Credit Hours: selected from the following courses according to the FMS offering.

Course No.	Course Name	Credits	Pre-Request
5501712	Benthos and Coral Reefs	3	(5501711)
5501713	Fish Biology and Ecology	3	(5501711)
5501714	Fishery and Aquaculture	3	(5501711)
5502701	Integrated Coastal Zone Management	3	--
5502702	Environmental Impact Assessment (EIA)	3	--
5502703	Special Topics in Marine Sciences	3	Department Approval
5502722	Numerical Modeling in Marine Sciences	3	(5502721)
5501715	Marine Molecular Biology and Biotechnology	3	(5501711)

3. Master Thesis (5502799)

Fourth –Course description

5501711 **Biological Oceanography** (Credit hours: 3)

Pre-Request: --

Examines marine organisms, their special and temporal distribution in the oceans, examining predation phenomenon and physiochemical factors affecting the distribution of marine planktons, exploratory study for the different marine ecosystems and the ecology of coral reefs, and the impact of climatic changes on them. Discussions of the current research on planktons, microbial loops, benthic organisms, marine resources and climate change.

- 5502721 **Physical Oceanography** **(Credit hours: 3)**
Pre-Request: --
Observations; instruments; physical properties of seawater; property distributions; characteristics of water masses; heat budget; kinematics; gravity pressure; hydrostatics; stability; horizontal flow; Coriolis force; geostrophy; friction; wind drift; general circulation; wave motions; tides.
- 5502731 **Chemical Oceanography** **(Credit hours: 3)**
Pre-Request:
Chemical composition and properties of seawater; Solubility of gases in seawater; Carbon dioxide solubility in seawater and the pH buffer system. Organic and inorganic nutrients in seawater; Primary productivity in seawater; Dissolved and particulate matter.
- 5502741 **Geological Oceanography** **(Credit hours: 3)**
Marine geological investigation, fundamental processes causing rifting and the formation of continental margins and deep sea basins. Sedimentary processes in marine environments (constructive and destructive coastal processes) and sea level history, natural causes of climate change, principles of paleoclimatology (tools, data and ideas), interpretation and reconstruction of recent and ancient marine environments by the help of marine proxy records (such as marine sediments, corals).
- 5502751 **Research Methods** **(Credit hours: 3)**
Study of the scientific method and the general principles of scientific research in the field of marine science represented significant achievements in this area in terms of various specialized data processing, as well as design of experiments, information retrieval and writing scientific and technical report, protect intellectual property and discoveries. Students shall prepare and submit reports as well as present seminars on selected topics and considers these reports and seminars within assess student work during the semester.
- 5501712 **Benthos and Coral Reefs** **(Credit hours: 3)**
Pre-Request: Biological Oceanography (5501711)
Description of bottom living organisms, their distribution within the different habitats in addition to the identification of coral reef ecosystem, distribution and interaction with the different inhabitants and habitats. Special focus will be given to the Gulf of Aqaba and the Red sea.
- 5501713 **Fish Biology and Ecology:** **(Credit hours: 3)**
Pre-Request: Biological Oceanography (5501711)
Diversity of fishes and distribution patterns and contents of the major groups fish classification and basic structures, with emphasis on fishes of the Gulf of Aqaba. Comparative anatomy and physiology of fish body systems and their integration into the whole fish. Ecology of

fishes, inter-relationships and the aquatic habitats they occupy. Practical study of fish populations, assemblages and their communities in the Gulf of Aqaba.

- 5501714 **Fishery and Aquaculture** **(Credit hours: 3)**
Pre-Request: Biological Oceanography (5501711)
This course will introduce students to the fundamentals and techniques of fisheries oceanography and enable the understanding of fish life history, recruitment, growth, habitat considerations and introductory fisheries stock assessment. This course provides a background on the development of fisheries science globally and examines the theories of fishery management.
Detailed and advanced information on methods implemented in marine aquaculture including brood stock maintenance, nutritional requirement and breeding. Natural and induced breeding, hatcheries, egg maintenance, live food requirements, early stages development, nutrition and feed composition and requirements. The course provides also the environmental requisites in aquaculture as well as the recent know how and its use in this industry.
- 5502701 **Integrated Coastal Zone Management** **(Credit hours: 3)**
Conceptualization, policy design, methodology, tools and techniques for coastal zone management; interdependence of managerial functions related to the improvement of coastal planning and management; integration of coastal zone development policies and their implementation; multidisciplinary aspects of the CZM-approach; guiding and supporting multidisciplinary teams in complex situations.
- 5502702 **Environmental Impact Assessment (EIA)** **(Credit hours: 3)**
Overview of Environmental Impact Assessment (EIA). Basics, purposes, aims, and objectives of EIA. Inter-relation between EIA and sustainable development. Principles, components and phases of EIA. Law, policy and institutional arrangements for EIA systems. Public involvements, screening, scoping, impact analysis, mitigation and management. Reporting, and review of EIA quality. Decision making, implementation and follow up, EIA projects management.
- 5502703 **Special Topics in Marine Sciences** **(Credit hours: 3)**
Pre-Request: Department Approval.
Special studies designed to supplement regular offerings in the program or to investigate a selected problem in biological, chemical, physical or geological oceanography under the direction of the faculty members of marine sciences. More than one section could be offered at a given semester under the supervision of the faculty members according to their research interest.
- 5502722 **Numerical Modeling of Ocean Circulation** **(Credit hours: 3)**
Pre-Request: Physical Oceanography (5502721)
This course focuses on modeling, data analysis and numerical techniques for marine science. The first part covers statistics: singular value decomposition, error propagation, least squares regression, principal component analysis, time series analysis and objective

interpolation. The second part deals with modeling techniques: finite differences, stability analysis and optimization. The third part describes case studies of actual ocean models of ever increasing dimensionality and complexity, starting with zero-dimensional models and finishing with three-dimensional general circulation models.

5501715

Marine Molecular Biology and Biotechnology: (Credit hours: 3)
Pre-Request: Biological Oceanography (5501711)

To provide an overall understanding of the structure, function, and information encoded in genes and proteins. Gene organization, function and evolution, and its applications in marine topics; such as biogeochemistry and biotechnology, including the use of marine biotechnology for economic development, environmental problem solving, bioremediation, and development of transgenic marine organisms.