Sana'a University

Faculty of Petroleum and Natural Resources

Environmental Sciences Department

Handbook
of Environmental Sciences
B.Sc. Programs

2020-2021

بسم الله الرحمن الرحيم

Handbook of Environmental Sciences Programs
Faculty of Petroleum and Natural Resources

Introduction:

The Environmental Sciences Department was established in line with the establishment of the Faculty of Petroleum and Natural Resources in September 2019. It has been developed from the former Environment Section in the former Department of Earth and Environmental Sciences at the Faculty of Science - Sana'a University. Establishment of this department came due to the growing needs for graduates specializing in contemporary environmental issues. Those who have the ability to solve current environmental problems and develop future strategies to avoid negative environmental impacts from the increasing humanitarian activities in the Republic of Yemen. When designing bachelor's and master's programs in the department, we have been keen to qualify the department's graduates to carry out their responsibilities in environmental management commensurate with the development in this field in regional and global countries, and in a way that enables them to compete with graduates of the corresponding universities, in addition to their ability to spread environmental awareness among Yemeni society.

Department Mission:

Preparing cadres with a scientific competence in order to keep up to date of developments in the field of environment, and a high professional capacity to compete in the market, and meet the needs of society in various sectors related to the environment.

Department Aims:

The Department of Environmental Sciences aims at the following:

1. Providing state institutions with specialized cadres capable of participating effectively in monitoring and preserving the Yemeni environment and solving problems related to it.
2. Conducting environmental studies and research as well as providing consultations in this field to various relevant institutions and sectors.
3. Contribute in spreading environmental culture and awareness among various sectors of Yemeni society by various means.
4. Building academic and research bridges that enhance joint cooperation between the department and its corresponding departments locally, regionally and internationally.
5. Development of academic programs and scientific research for postgraduate students.

The B.Sc. in Environmental Science Program

The structure of the environmental sciences undergraduate program, and its curriculum map was prepared, designed, and built based on surveying similar reference program structures. The program follows semester system, and the department graduates will obtain a B.Sc. degree (major: environmental sciences) after completing four years (8 semesters), and passing 132 study hours.

The program courses are divided into three main areas, which are: university requirements with 19 credit hours, Faculty requirements with 40 credit hours, and major specialization courses (program requirements) of 73 credit hours. The team in charge of structuring the department's courses has ensured that at the end of the fourth year of study, the student will acquire all the theoretical information, and practical skills sufficient to make him able to conduct various and different environmental investigations, in order to qualify him for competition for job opportunities in any field related to the environment in accordance with international quality standards, which will allow postgraduates to create their own careers and carryout higher scientific researches.

Conditions for Admission:

The department accepts Secondary school graduates (scientific section) or its equivalent, who have achieved an average score of 75%, and after passing the entrance exams, or any other conditions set by Sana'a University for admission and registration.

The Study Plan:

The Environmental Sciences B.Sc. Program consists of 19 credit hours of university requirement which are:

University Requirements		
No.	Course	C.H.
1	Islamic Culture	3
2	Arabic Language (1)	3
3	Arabic Language (2)	3
4	English Language (1)	3
5	English Language (2)	3
6	Arabic Zionist Conflict	2
7	National Culture	2
Total Credit Hours (C.H.)		**19**

There are also a number of compulsory courses for the study of the program, and these courses are among the requirements of the Petroleum and Natural Resources Faculty, with a total of 40 credit hours, which are as follows:

Faculty Requirements		
No.	Course	C.H.
1	General Geology (1)	3
2	General Geology (2)	3

3	General Math	3
4	General Chemistry	3
5	General Physics	2
6	Principles of Environmental Sciences	3
7	Computer Programming	3
8	Sedimentology & Stratigraphy	3
9	Geophysics	3
10	Statistics	3
11	Principles of Engineering Geology	2
12	Structural Geology	3
13	Remote Sensing and GIS	3
14	Geology of Yemen	3
Total Credit Hours (C.H.)		**40**

There are a number of compulsory specialized requirements that the student should pass in order to complete the program, and the total credit hours of these courses amount to 73, and these courses are:

Program Requirements		
No.	Course	C.H.
1	General Biology	3
2	General Botany	3
3	Zoology	3
4	Biodiversity	3
5	Organic Chemistry	3
6	Analytical Chemistry (1)	3
7	Analytical Chemistry (2)	2
8	Aquatic Pollution	3
9	Instrumental Analysis	3
10	Air Pollution & Climate Change	3

11	Geomorphology	3
12	Marine Geology	3
13	Hydrogeology	3
14	Pedlogy	3
15	Economics of Natural Resources	2
16	Waste Management	3
17	Environmental Hazards	3
18	Land Uses & Urban Ecology	2
19	Integrated Environmental Management & EIA	3
20	Ecosystems & Natural Resources	2
21	Environmental Law	2
22	Climatology	2
23	Marine Ecology	3
24	Research Methods & Scientific Writing	2
25	Energy & Environment	2
26	Environment of Yemen	2
27	Graduation Project (1)	2
28	Graduation Project (2)	2
Total Credit Hours (C.H.)		**73**

The above program courses were distributed by taking into account the balance between specialized courses and university and faculty requirements. Also, it was taking into account the pre-requisites of each course separately in a way that did not affect the logical sequence of learning and the acquisition of knowledge and skills of the environmental specialization. The study plan for the B.Sc. Environmental Sciences Program courses are distributed as follows:

First Year:

First Semester						
No.	**Course Title**	**Code**	**Credit Hours**			**Pre-requested**
			Th.	**Pr.**	**Total**	
1	Islamic Culture	UR105	3	0	3	-
2	Arabic Language (1)	UR101	3	0	3	-
3	English Language (1)	UR103	3	0	3	-
4	General Geology (1)	PNR111	2	1	3	-
5	General Maths	PNR113	2	1	3	-
6	Arabic Zionist Conflict	UR107	2	0	2	-
Total Credit Hours					**17**	
Second Semester						
No.	**Course Title**	**Code**	**Credit Hours**			**Pre-requested**
			Th.	**Pr.**	**Total**	
1	Arabic Language (2)	UR102	3	0	3	UR101
2	English Language (2)	UR104	3	0	3	UR103
3	General Geology (2)	PNR112	2	1	3	PNR111
4	General Chemistry	PNR114	2	1	3	-
5	General Physics	PNR115	2	1	3	-
6	Principles of Environmental Sciences	PNR116	2	0	2	-
7	National Culture	UR106	2	0	2	-
Total Credit Hours					**19**	

Second Year:

First Semester						
No.	**Course Title**	**Code**	**Credit Hours**			**Pre-requested**
			Th.	**Pr.**	**Total**	
1	Sedimentology & Stratigraphy	PNR212	2	1	3	PNR112
2	Geophysics	PNR213	2	1	3	PNR112
3	Principles of Engineering Geology	PNR215	2	0	2	PNR112
4	General Biology	ENV221	2	1	3	-
5	Organic Chemistry	ENV231	2	1	3	PNR114
6	Geomorphology	ENV241	2	1	3	PNR112
Total Credit Hours					**17**	
Second Semester						
No.	**Course Title**	**Code**	**Credit Hours**			**Pre-requested**
			Th.	**Pr.**	**Total**	
1	Computer Programming	PNR211	2	1	3	-
2	Statistics	PNR214	2	1	3	-
3	General Botany	ENV222	2	1	3	ENV221
4	Analytical Chemistry (1)	ENV232	2	1	3	PNR114
5	Marine Geology	ENV242	2	1	3	PNR112
6	Economics of Natural Resources	ENV251	2	0	2	PNR113
Total Credit Hours					**17**	

Third Year:

First Semester						
No.	**Course Title**	**Code**	**Credit Hours**			**Pre-requested**
			Th.	**Pr.**	**Total**	
1	Structural Geology	PNR311	2	1	3	PNR112
2	Analytical Chemistry (2)	ENV333	0	2	2	PNR114
3	Hydrogeology	ENV343	2	1	3	-
4	Waste Management	ENV352	2	1	3	-
5	Climatology	ENV361	2	0	2	-
6	Marine Ecology	ENV362	2	1	3	ENV221, PNR116
Total Credit Hours					**16**	
Second Semester						
No.	**Course Title**	**Code**	**Credit Hours**			**Pre-requested**
			Th.	**Pr.**	**Total**	
1	Remote Sensing & GIS	PNR312	2	1	3	-
2	Geology of Yemen	PNR313	2	1	3	ENV241
3	Zoology	ENV323	2	1	3	ENV221
4	Aquatic Pollution	ENV334	2	1	3	ENV232, ENV333
5	Environmental Hazards	ENV353	3	0	3	PNR215, ENV361
6	Research Methods & Scientific Writing	ENV363	1	1	2	-
Total Credit Hours					**17**	

Fourth Year:

First Semester						
No.	**Course Title**	**Code**	**Credit Hours**			**Pre-requested**
			Th.	**Pr.**	**Total**	
1	Biodiversity	ENV424	2	1	3	ENV222, ENV323
2	Instrumental Analysis	ENV435	2	1	3	ENV232, ENV333
3	Air Pollution & Climate Change	ENV436	2	1	3	ENV361
4	Land Uses and Urban Ecology	ENV454	2	0	2	-
5	Energy and Environment	ENV464	2	0	2	-
6	Graduation Project (1)	ENV466	0	2	2	ENV363
Total Credit Hours					**15**	

Second Semester						
No.	**Course Title**	**Code**	**Credit Hours**			**Pre-requested**
			Th.	**Pr.**	**Total**	
1	Pedlogy	ENV444	2	1	3	-
2	Environmental Management & Environmental Impact Assessment	ENV455	3	0	3	PNR116, ENV334, ENV436
3	Ecosystems & Natural Resources	ENV456	2	0	2	PNR116, ENV251
4	Environmental Law	ENV457	2	0	2	-
5	Environment of Yemen	ENV465	2	0	2	PNR116, ENV362, ENV424
6	Graduation Project (2)	ENV467	0	2	2	ENV363
Total Credit Hours					**14**	

Description of the Courses Presented by the Department:

Principles of Environmental Science **PNR116**

This course introduces the basic concepts and principles of environmental sciences such as Its definition, divisions, importance, and history. It provides information about world's major ecosystems. It describes the relationship between organisms and the flow of energy through the ecosystem. It summarizes the major present environmental problems and the attempts to solve it.

General Biology **ENV221**

This course enables the student to learn the basic concepts of biology and its branches, and how to identify living organisms. It deals with the chemical composition of protoplasm, cell structure, types and functions, metabolism, and how a living cell obtains energy. It also provides a simplified description of living organisms classification, and their relationships with the surrounding environment.

General Botany **ENV222**

This course aims to introduce the student to botany and its different branches. It also enables the student to recognize different taxonomic groups in the plant kingdom; demonstrate the characteristics of the plant cells and clarify the differences between plant cell and the animal cell and give the experience and skill necessary to distinguish between plants through their morphological and anatomical characteristics and arrange them in their appropriate taxonomical groups; submit the student with the different modifications that appear in the different parts of plants which enable them to adapt to environmental changes and to familiarize the student with the important physiological processes that take place in the plant cell (Metabolism).

Organic Chemistry **ENV231**

This course provides students the opportunity to learn the nature of carbon element in organic compounds, as it provides a systematic study of the theories, principles, and techniques of organic chemistry. It includes nomenclature, structure, properties, synthesis and reactions of different organic compounds.

Analytical Chemistry (1) **ENV232**

This course is to understand the laws of analytical chemistry that exist to solve problems in a logical and automated way, how to analyze these laws that deal with the problems

of preparing chemical solutions and know the calculation of the concentration for each of them, which helps to choose the exact weight for preparing the required solution from a group of solutions. As well as identifying modern methods of analysis, their characteristics and advantages from the previous ones, which are weighty and volumetric analysis that are rich in definition and using their sources to solve the issues raised in the academic decision.

Geomorphology **ENV241**

Providing students with the main concepts of the geomorphology and it's applied, and explain geomorphological factors and processes that Influencing Earth's surface formation. Introduce students to methods of measuring surface phenomena and sign them on appropriate maps and figures. Providing students with methods for identifying geomorphological phenomena and determining the stages of their development, Identify the relation between geologic structure and existing landforms.

Marine Geology **ENV242**

This course is designed primarily for students in Environmental Sciences and other relevant disciplines. However, it provides valuable information for the students in the field of geosciences. This course will cover the formation of ocean basins, ocean geomorphology; sedimentary processes within and on the boundaries of ocean basins; and the past history and impact of sea level change. In addition to ocean physical processes; and elemental composition of sea water.

Economics of Natural Resources **ENV251**

This course introduces students to economic issues specific to the use and management of natural resources. It explores the economic principles for the efficient allocation of resources over time. Topics covered typically include the economic classification of natural resources; scarcity, growth and sustainability; ownership, access systems and rent dissipation; and principles of optimal depletion and use. Policies and mechanisms to foster greater economic efficiency in economic systems dependent on natural resources are examined.

Zoology **ENV323**

To provide students with knowledge about the general classification of the Animal kingdom and phylogeny, diversity of invertebrates and vertebrates life, their evolutionary succession and their importance to man.

Analytical Chemistry (2) **ENV333**

The course includes an introduction to the fundamental principles of gravimetric. It introduces new equipments, techniques and skills that enable the students to perform various experiments in precipitation and complexo-metric reactions. The course also gives information about the different types of pollution that may occur during the analysis. It provides information on the advantages and disadvantages of gravimetric analysis methods.

Aquatic Pollution **ENV334**

This course aims to identify pollution problems that aquatic bodies and underground water are subjected to, in addition to identify its reasons, sources, optimal solutions for treatment of these aquatic environmental issues and problems that society is facing.

Hydrogeology **ENV343**

This course aims to acquire the student general knowledge about groundwater occurrences, origin and flow, interpretation of hydrogeologic conditions in different groundwater environs and identification of important processes in water-rock and surface water – groundwater interactions. It aims to give students a sound understanding of how water moves below the surface, including soil and groundwater flow. The teaching focuses on a physical understanding of key processes in the hydrological cycle that control the state and movement of water in the subsurface. The knowledge is the basis for addressing practical aspects such as: how to apply common and advanced techniques in hydrogeology, how to solve practical problems and which tools can be used in each case.

Waste Management **ENV352**

This course introduces students to the basic principles of solid and liquid waste management, which include in addition to municipal wastes and domestic sewage, industrial, medical, construction, and hazardous wastes, in addition to introduce students to the classification of wastes and their sources, and their impacts on environment and human health, and the methods used for waste quantification and treatment and ultimate disposal.

Environmental Hazards **ENV353**

This course provides the students with basic concepts and principles of environmental risks, disasters, and Hazards, its classification, types, either Natural (Geological, and

Climatic) or man-made, and the ways of predicting, identifying, and avoiding them through proper management.

Climatology **ENV361**

To provide students with knowledge about the basic concepts of climate, weather and meteorology, and the nature of atmosphere, different types of climate, and their constituents. In addition to, the meteorological elements, the devices and methods used in measuring them, the factors affecting climate, as well as effects of climate in distribution of ecosystems.

Marine Ecology **ENV362**

The aim of this course is to provide students with information, concepts and principles relevant to ecological knowledge in general and to properties of the marine environment and the interactions between marine organisms with each other and with the surrounding environment. This course will deal with study the environmental subdivisions of the ocean, pelagic and benthic communities and the important tropical marine environments such as coral reefs and mangroves environments with special reference to the Yemeni marine environment. Also, this course will show the human impacts on the marine environment and how can we limit and mitigate such impacts.

Research Methodology & Scientific Writing **ENV363**

This course introduces the basic concepts of Research Methodology & Scientific Writing, which includes scientific research, scientific methodology, and the benefit of scientific research methodology in environmental sciences. Data and sample collection from field, lab and library. Use of traditional and electronic library. Representing of environmental information, quantitative and qualitative data analyzing, in addition to writing of reports, researches and thesis.

Biodiversity **ENV424**

The aim of this course is to provide students with information, concepts and principles relevant to concept, measuring, geographical distribution, importance and usage, the causes of spatial and temporal changes and the effective role of biological diversity in ecological systems and the biosphere. In this course students will acquire the required knowledge to be aware of harmful human activities damaging biodiversity and the optimal approaches for conservation and sustainable use of living natural resources.

Instrumental Analysis **ENV435**

This course introducing the students to the instrumental methods of analysis including spectroscopic methods; electochemical methods and chromatographic methods of analysis as an advanced analytical chemistry techniques used in the analysis of the elements and compounds in different environmental samples. It focuses on the basic principles, instrumentations, applications, advantages and limitations of each technique. Experiments offered in the practical part of this course are tailored to provide the students with a firsthand application of the theoretical concepts studied.

Air Pollution & Climate Change **ENV436**

This course aims to identify pollution problems of atmosphere, and its causes, sources, optimal solutions for treatment of these air pollution issues, in addition to recognize the causes of climate change such as global warming, ozone depletion, and acid rains, and identify the effects of these issues on global environment.

Pedlogy **ENV444**

This course introduces the basic concepts and principles of pedlogy such as Its definition, content, phases, divisions, classifications, importance, and history. It provides information about soil uses and mineral cycle. Understanding of soil problems such as salinity and avalanche of soil, the environmental problems and its treatments.

Land Uses and Urban Ecology **ENV454**

This course is interested in providing students with basic information about urban development in cities, and theories that discussed the distribution of land use, and the factors that affect this distribution, in addition to the prices of land in the city, and their role in identifying the quality of use, the main components of economic baseline, and the spatial relationship between the city and its surroundings. In addition to identifying of environmental problems which affects the city such as population congestion, pollution, scarcity of water and energy, and other problems that are always preceded in the cities.

Environmental Management & EIA **ENV455**

This course will introduce students to the underlying key environmental processes and services, ecosystem management, techniques of optimization overtime, optimal allocation and management of non-renewable and renewable resources. Also, to introduce students to the proper ways and internationally recognized methods and

approaches of environmentally assessing small and large development projects for their impacts on the surrounding environment including impacts on humans.

Environmental Systems and Natural Resources **ENV456**

The aim of this course is to provide students with information and principles related to different types of environmental systems (terrestrial and aquatic) and also to show importance of the different types of natural renewable and non-renewable resources and how can we use and conserve them perfectly in various ecosystems.

Environmental Laws **ENV457**

This course aims to explain the importance of environmental laws, and reviews the evolution of environmental legislations in the world and the Arab region as well as Yemen, in addition to review of the most important international conventions and treaties on environmental issues and its importance and impact on Yemen's environmental law.

Energy and Environment **ENV464**

To provide students with knowledge about the basic concepts of energy, its sources, and different uses, in addition to distinguishing between conventional (non-renewable) and non-conventional (renewable) energy sources, as well as the ability to describe its negative and positive impacts on environment, and the proper way to solve those negative impacts such as energy savings that lead to environment conservation.

Environment of Yemen **ENV465**

The aim of this course is to provide students with information and principles relevant to the environment of Yemen and the various types of terrestrial and aquatic habitats found in it. Also, to make students able to identify the importance of natural resources found in Yemen and how can we conserve and use them in sustainable manner. In addition, to make students able to find out the environmental problems caused by human impacts and the suitable methods to limit and prevent them.

Graduation Project (1) **ENV466**

Graduation Project (2) **ENV467**

These two courses aim to provide an opportunity for the student to conduct a field research on a specific topic given to him by the department, under a supervision of any of the academic staff, in field and lab, and write a scientific report on the results that he

found and discuss these results and conclusions regarding environmental science and issues.

Job Opportunities:

Graduates of the Department of Environmental Sciences have many job opportunities available in many governmental and private institutions, the most important of which are but not limited to:

- Ministry of Water and Environment.
- Environmental Protection Authority (EPA).
- Water and Sanitation Local Corporation (WSLC) in any of the Yemeni governorates.
- Departments related to environment and its preservation in any of the local governmental authorities in governorates.
- Ministry of Fish Wealth.
- Ministry of Agriculture and Irrigation.
- Maritime Affairs Authority.
- Yemen Ports Authority.
- Ministry of Planning and International Cooperation.
- Social Fund for Development (SFD).
- Ministry of Industry and Trade.
- General Investment Authority.
- Geological Survey and Mineral Resources Board.
- Private Sector such as industries, oil or mining companies, *etc*.
- Local and international organizations working in the environmental field.
- Environmental Consulting Offices.
- Any other institutions related to environmental issues.