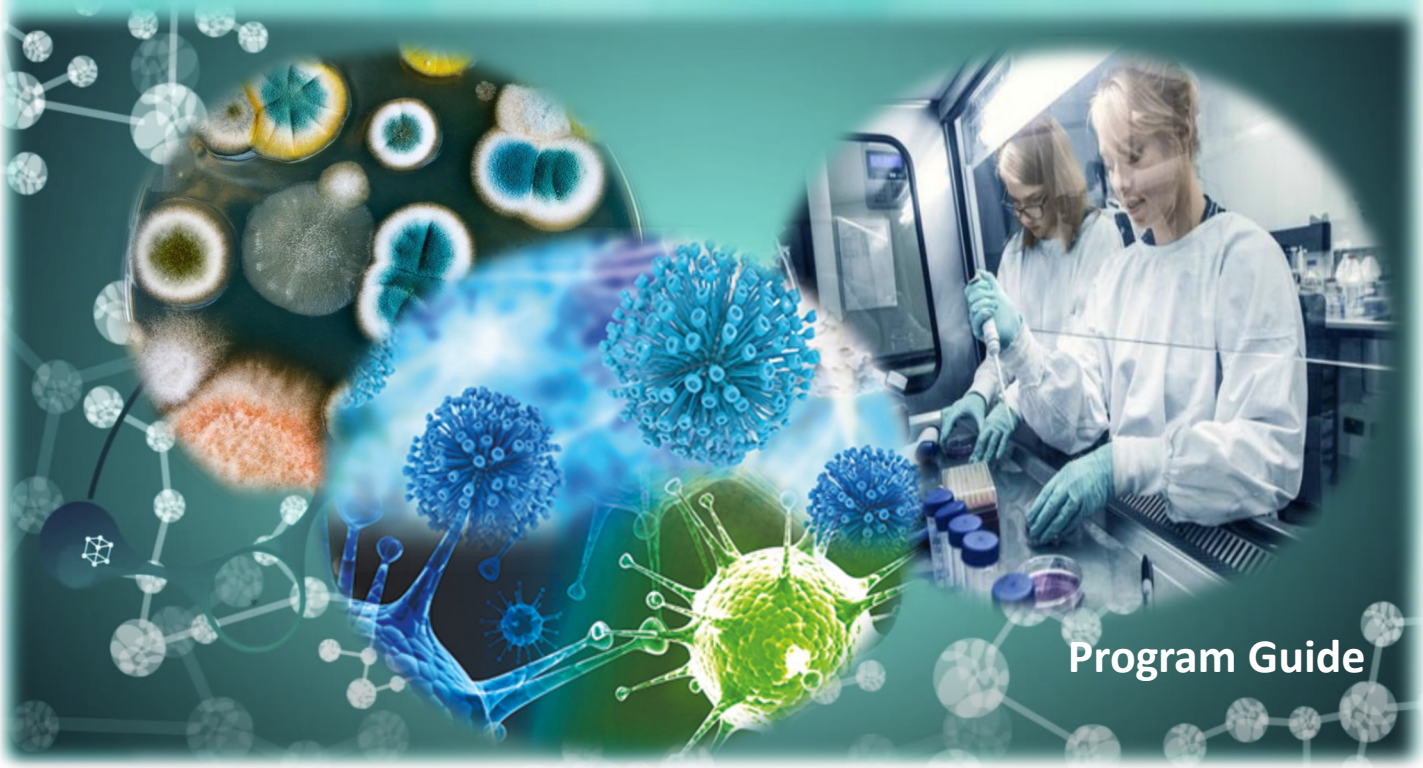
M.Sc.
ENVIRONMENTAL MICROBIOLOGY AND BIOTECHNOLOGY

Department of Biology
College of science
Princess Nourah bint Abdulrahman university



Program Guide

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جامعة الأميرة نورة بنت عبدالرحمن
Princess Nourah Bint Abdulrahman University

M.Sc. ENVIRONMENTAL MICROBIOLOGY AND BIOTECHNOLOGY

بســـم الله الرحمـــــن الرحيـــــم
قال الله تعالى { يرْفَعِ اللَّهُ الَّذِينَ آمَنُوا مِنكُمْ وَالَّذِينَ أُوتُوا الْعِلْمَ دَرَجَاتٍ}.صدق الله العظيم
عن أبي هريره رضي الله عنه قال قال رسول الله صلى الله عليه وسلم {من سلك طريقا يلتمس فيه علما سهل الله له به طريقا إلى الجنة } .أخرجه مسلم

PREPARED AND PRESENTED BY
DR. ASHWAG SHAMI

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1. Introduction

The University strives to establish and develop an academic and scientific environment that acts as an incubator for internationally influenced postgraduate programs, through effective twinning and partnership agreements with highly regarded and ranked international and internal universities. The University aspires to offer postgraduate programs that comply with the highest levels of quality and excellence, bearing in mind that postgraduate studies aim to provide academic cadres with scientific and academic qualifications, and develop them in the different fields, according to the needs of society, scientific development, and the requirements of the knowledge-based society.

2. Admission requirements

The program accepts the bachelor's degree in (biology, and related health sciences). In addition to the conditions stipulated in the unified regulations for postgraduate studies of the Ministry of Higher Education, the applicant must fulfill the following conditions:

- To be Saudi or resident
- Bachelor's degree GPA should not be less than 3.75 / 5.00
- 5 IELTS or equivalent in other language tests (STIP =81, TOEFL=500)
- Official approval from the employer to study for two academic years
- Fill out the application on the University website.

3.Amis and Scope

The Program provides introduction to Environmental microbiology and biotechnology. The program is comprised of courses consisting of lectures, seminars and laboratory classes and each course provides an in-depth review of the subject.

4. Master Degree Requirements

It is the sole responsibility of the student to plan her graduate program in consultation with her advisor. Students are required to meet all deadlines. Students should be aware that most core courses are offered only once per year. The Master's Degree (M.Sc.) is awarded upon successful completion of a minimum of 36 credit hours.

4.1 M.Sc Course Requirements

- Pre-Master Courses
- Core Courses
- Elective Courses
- Research project end by writing a dissertation

5. Study Plan

The M.Sc. degree at PNU is a 50-credit program. Students are expected to complete the M.Sc. degree in six semesters. Thesis option requires 50 credits of coursework with an additional 9 credit hours of research. Students must apply by the ninth week of their second semester with permission of the M. Sc. Thesis Advisor.

5.1 Pre-Master Courses (12 credits)

The mandatory courses are the compulsory course that is determined essentially by the program organisation for the students to complete to attend the Master program. Four modules are essential for attending the master program which are

- Molecular Biology
- Introduction to microbiology
- Cell biology
- Biochemistry

5.2 Core Courses (20 credits)

These core courses are designed to provide a student with the background needed to establish a solid foundation in the program area.

5.3 Elective Courses (21 credits)

The elective courses are designed to allow each student to tailor her educational experience to meet individual research and educational objectives, with the permission of the student's academic advisor.

5.4 Research project end by writing a dissertation (9 credits)

Students must write a thesis as part of their M.Sc. Degree and must identify a Research Advisor. The selected thesis advisor must be a fulltime program-affiliated Assistant, Associate or Full Professor at PNU or any organisation. This advisor can only become project-affiliated for the specific thesis project upon program level approval. Project-affiliation approval must be completed prior to commencing research**.**

6. Program Courses and Description

6.1 Core Courses: (20 credits)

BIO 831 Fundamentals of Environmental Microbiology
BIO 811 Genomics
BIO 812 Fundamental of Bioinformatics & Information
BIO 822 *Lab Techniques in Microbial Biotechnology*

6.2 Elective Courses: (21 credits) are as follows:

BIO 801 Biostatistics
BIO 821 Processes in Environmental Biotechnology
BIO 832 Microbiological Aspects of Water Sources, Treatment and Distribution

BIO 833 Public Health Microbiology
BIO 834 Advanced Environmental Microbiology
BIO 835 Microbial Genetics
BIO 836 Microbial Applications of Synthetic Biology
BIO 837 Microbiology and Immunology
BIO 838 Introduction to Microbial Biochemistry
BIO 839 Industrial Microbiology
BIO 861 The Cell: Structure, Development and Physiology
BIO 881 Essentials of Scientific Writing

* Courses should be selected with the permission of the Academic Davison who will be assigned to students.
* Students must register in and attend the program's graduate seminars in addition to the above courses. Credits are not awarded for these seminars but satisfactory participation is mandatory to complete the Master's Degree.

6.3 Courses and Description

BIO 801 Biostatistics

This course is designed for master students, given over 14 weeks. This biostatics course covers the principles of statistical parameters used to analyze and interpret the data collected or generated in biological labs. The course focus on practical exercises in the statistical programs SPSS. The course equips student with the skills to professionally analyze biological data using SPSS statistical software and presenting these data graphically.(Students will require their own laptops for this course).

BIO 811: Genomics

Principles and technologies for generating genomic information for ecological, biomedical and biotechnological applications.

Technologies will be introduced progressively, from DNA to RNA to protein to whole cell systems. The integration of biology, chemistry, engineering, and computational sciences will be stressed. Topics include: Technology for the High-throughput Sequencing, Methods for annotating genomes, characterizing functional genes, Gene Expression, Comparative Genomics, Population Genomics, Proteomic Technologies and Systems Biology.

BIO 812 Fundamental of Bioinformatics & Information

The course provides a comprehensive overview of the use of informatics in the biological sciences. It offers a theoretical and technical grounding in a variety of application areas counting bioinformatics-related topics such as sequence analysis, phylogenetic, and the modelling of proteins; and higher level subjects such as modelling of pathways, ecosystems and evolution.

BIO 821 Processes in Environmental Biotechnology

A course that introduces graduate students from different engineering and science disciplines to the fundamental principles of microbiology and engineering (quantitative tools) and discusses example applications of microbiological processes for wastewater treatment and resource recovery.

BIO 822 Lab Techniques in Microbial Biotechnology

Study of microorganisms to include bacteria, viruses, fungi, and protozoa with emphasis on laboratory methodology and the structure and function of common microorganisms of medical relevance and provides an overview of how microbes (e.g., bacteria, viruses and yeast) are manipulated to solve practical problems through biotechnology.

BIO 831: Fundamentals of Environmental Microbiology

This course is designed to provide introductory concepts on fundamentals of environmental microbiology to students from science disciplines. Concepts related to the different molecular biology tools used in microbial ecology with also be introduced. The course will equip students with knowledge to apply these tools to unravel scientific questions relevant to natural and engineered biological processes.

BIO 832 Microbiological Aspects of Water Sources, Treatment and Distribution

This course addresses microbiological aspects of water sources, drinking water production and distribution. The topics to be covered include: microbiology basics, pathogens, drinking water production, biological stable water, distribution of drinking water (e.g. effect of material types), biofilms, biofouling, biofouling of membranes, biofilm modelling, etc. There will be student seminars, guest lecturers and a research center visit.

BIO 833 Public Health Microbiology

An introduction to the diversity of microbial agents that can impact the public health and environmental systems. The course is structured to detail the microbial hazards found in waters, soils and air. Molecular biology techniques and the current regulatory methods for investigating pathogens and the surrogate indicators will be discussed. Treatment and engineering strategies are discussed.

The latter part of the course serves to provide an introduction to Quantitative Microbial Risk Assessment (QMRA). The concepts related to exposure assessment and risk characterization will be included. Practical lab classes will be incorporated as soon as student laboratories are available.

BIO 834 Advanced Environmental Microbiology

The course introduces the principles and applications of microbial biotechnology for the environment under the concepts of Microbial Resource Management. The course illustrates the biology, ecology, production and application of microorganisms for sustainable agriculture and environmental bioremediation and cleanup. The course is divided in four sections: 1) "Microbial diversity and soil fertility" illustrates prokaryote phylogeny and the microbial role in the soil/plant ecosystem. 2) "Microbial antagonism and biocontrol" deals with the biology, ecology and biotechnology of symbiotic and antagonistic microorganisms against phytopathogens and insects. 3) "Microbial technologies for environmental decontamination and bioremediation" introduces the metabolic pathways for pollutants degradation and the technologies for their exploitation in aquatic and terrestrial ecosystems. 4) "The industrial production of microorganisms for environmental applications" illustrates the principles of industrial microbiology including strain selection, microbial growth, and the fermentative process.

BIO 835 Microbial Genetics

This course provides a firm grounding in microbial structure, physiology, and behaviour at the molecular level. The course will introduce a comprehensive understanding of a particular concept, such as: The mechanisms behind stability and change in microbial genomes. The underlying mechanism behind microbial resistance for the verity of antimicrobial and antifungal agents.

BIO 836 Microbial Applications of Synthetic Biology

This course will introduce the hypothesis of synthetic biology, which is described as the construction and reconstruction of biological systems, and its practical applications in research and industry. Advanced molecular biology tools for DNA assembly, the construction of biological pathways and circuits, genome editing, and strategies for transcriptional control will be examined in the course.

BIO 837 Microbiology and Immunology

This course will provide knowledge about structure and function of pathogenic virus and bacteria, with emphasis on molecular mechanisms regulating pathogenesis. The host organism's defence against infection are discussed in detail, as well as the ability of the infecting microbes to evade the immune response. A number of particularly important microbes are discussed in detail.

BIO 838 Introduction to Microbial Biochemistry

This course will provide knowledge about microbial ultrastructure and biomolecules, biochemical cycles; energy molecule formation; fermentations and transport mechanisms.

BIO 839 Industrial Microbiology

This course will provide knowledge about industrial application of microorganisms and recent microbial products such as the applied and industrial aspects of microbiology such as screening of microorganisms, strain improvement, microbial metabolites, fermented microbial products, microbial enzymes, Biofuels using microbes and microbial production of Biopolymers. The recent applications of the microbes for the human welfare.

BIO 861 The Cell: Structure, Development and Physiology

The scope of this course is to provide a comprehensive overview of eukaryotic cell structure and the fundamental functional aspects of membranes, organelles, nuclear architecture, genome and epigenome in the context of development, specialization, and integration with the environment.

BIO 881 Essentials of Scientific Writing

This course develop competency in scientific research skills, acquire skills and concepts inherent in the science research experience. The students will practice scientific thinking and learn scientific processes, which may advance the student in their educational and career goals.

7.Thesis Defense Requirements

An oral defense of the M.Sc. Thesis is required. A requirement of a public presentation and all other details are left to the discretion of the thesis committee. A written thesis is required. It is advisable that the student submits a final copy of the thesis to the Thesis Committee Members at least two weeks prior to the defense date.

8. Thesis Defense Committee

The M.Sc. Thesis Defense Committee, which must be approved and must consist of at least three members and typically includes no more than five members. At least one of the required members must be PNU Faculty.

9. General Structure

- **First Semester**

Number	Course code and name	Units
1	Core Curriculum Required	5
2	Core Curriculum Required	5

- **Second Semester**

Number	Course code and name	Units
1	Core Curriculum Required	5
2	Elective Curriculum	4

- **Third Semester**

Number	Course code and name	Units
1	Core Curriculum Required	5
2	Elective Curriculum	4

- **Fourth Semester**

Number	Course code and name	Units
1	Elective Curriculum	4
2	Elective Curriculum	4

9. General Structure

- **Fifth Semester**

Number	Course code and name	Units
1	Elective Curriculum	4
2	Thesis	_

- **Sixth Semester**

Number	Course code and name	Units
1	Thesis	9