



Course Specification

(Bachelor)

Course Title: Environmental Biotechnology

Course Code: APEP3604

Program: Diploma - Technology of Environmental Protection

Department: Biology

College: Faculty of Sciences

Institution: Umm Al-Qura University

Version: 2

Last Revision Date: 12 / 2024



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A. General information about the course:

1. Course Identification

1. Credit hours: (2 theoretical + 1 practical)

2. Course type

A. ☐ University ☐ College ☒ Department ☐ Track ☐ Others
B. ☒ Required ☐ Elective

3. Level/year at which this course is offered: (.....)

4. Course General Description:

Environmental Biotechnology course describes how biotechnology has acted as a vital buffer among people, pollution, and the environment. This course explains the scientific principles of environmental biotechnologies; environmental biochemodynamic processes; environmental risk assessment; and the reduction and management of biotechnological risks. It describes ways to address environmental problems caused or exacerbated by biotechnologies. This course is mainly devoted to the contribution of biotechnology in solving environmental problems, such as biological waste water treatment, utilization of municipal sewage sludge, detoxification of polluted soil. There is examination of possible dangers release of nanomaterials into the environment. The relationship of biotechnology and energy (e.g. biogas, landfill gas fuel, photosynthetic systems for fuel production) is also discussed.

5. Pre-requirements for this course (if any):

Applied and Fundamentals of Environmental Microbiology

6. Co-requisites for this course (if any):

7. Course Main Objective(s):

This course is intended to:

- Provide students with the fundamental concepts and applications of biotechnology in all aspects of environment including its restoration, sustainability, and protection.
- Teach students the aspects of microbial metabolism and microbially mediated environmental and industrial problems or processes.
- Offer the students a broad sense of understanding on how modern biotechnology is developed to achieve better environmental protection and sustainability using microbes and microbial communities in pollution abatement.
- Encourage students to participate in continuing and emerging environmental biotechnological matters.
- Integrate the theoretical knowledge with the practical skills applied in the laboratory.
- Enhance the skills of self-directed learning and investigation of scholarly articles.
- Motivate students to participate in research activities and projects.



2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	30	80%
2	E-learning		20%
3	Hybrid <ul style="list-style-type: none"> Traditional classroom E-learning 		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	30 h
2.	Laboratory/Studio	14 h
3.	Field	
4.	Tutorial	
5.	Others (specify)	
Total		

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Describe the basic principles used in the field of Environmental Biotechnology.	K1	<ul style="list-style-type: none"> - Interactive lectures - Group discussions - Tutorials 	<ul style="list-style-type: none"> ▪ Written exams including: <ul style="list-style-type: none"> - Short answers - MCQs - EMQs - SAQs - LAQs ▪ Assignment
1.2	Define the important environmental biotechnology techniques and related processes	K2		
1.3	Recognize the various applications utilizing biotechnological methods.	K2		



Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.4	Describe the role of microorganisms in processes such as biofilm formation, biocorrosion, mineral leaching, composting, clean drinking water	K2 & K3		<ul style="list-style-type: none">▪ Open-book exam▪ Quizzes
2.0	Skills			
2.1	Critically analyze relevant journal articles and investigate industrial application of the above concepts.	S2	<ul style="list-style-type: none">- Interactive lectures- Tutorials- Practical work	<ul style="list-style-type: none">▪ Written exams including:<ul style="list-style-type: none">- Short answers- MCQs- EMQs- SAQs- LAQs▪ Assignment▪ Open-book exam▪ Quizzes▪ OSPE
2.2	Classify microbes according to energy source and carbon source and evaluate energy outcome of the energy metabolism according to electron acceptor and electron donor usage	S3		
2.3	Describe suitable methods for characterizing the activity, function, diversity, and composition of microbial communities.	S3 & S4		
2.4	Communicate effectively both orally and in writing for data analysis and consultation.	S5		
2.5	Perform accurate procedures used in the operation of related apparatuses.	S1		
2.6	Develop proper scholarly searching skills through scientific references	S4 & S6		
3.0	Values, autonomy, and responsibility			
3.1	Appraise the value of critical judgment through constructive criticism among colleagues.	V2	<ul style="list-style-type: none">- Tutorials- Practical work	<ul style="list-style-type: none">- Lab demonstration





Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
3.2	Demonstrate personal integrity, reliability, honesty, trustworthiness, teamwork, and ethical behavior toward others in the community.	V1 & V3 & V4	- Small group - Discussion	- Assignments - OSPE
...				

C. Course Content

No	List of Topics	Contact Hours
1.	Environmental Biotechnology and Sustainability.	2
2.	Different branches of biotechnology: medical, agricultural, environmental, and industrial biotechnology.	2
3.	The Environmental Implications of Biotechnology.	2
4.	Principles and Applications of Environmental Biotechnology	2
5.	Biological methods to redeem or mitigate the harmful effects of global pollution on the natural environment.	2
6.	Environmental Risks of Biotechnologies.	2
7.	Midterm-Exam	2
8.	Addressing Biotechnological Pollutants.	2
9.	DNA structure and function Modeling Activities	
10.	Genetic Engineering	2
11.	Reducing Biotechnological Risks.	2
12.	Environmental Nanobiotechnology	2
13.	Environmentally friendly Bioproducts.	2
14.	The laws of biotechnology: Use of Genetically Modified Organisms. Privacy Issues in Genomics. Intellectual Property Rights in Biotechnology	2
15.	Digital transformation in the environment -Environmental Internet: Using connected devices to collect environmental data such as temperature, air quality, and energy consumption. -Smart applications in transportation: Technologies to reduce emissions such as electric cars or smart traffic management systems. -Big Data: Analyzing huge amounts of environmental data to identify patterns and provide solutions to environmental problems	2





Total

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quiz 1 (Theory)	3	5%
2.	Midterm examination (Theory)	6	15%
3.	Midterm examination (practical)	7	10%
4.	Group project	9-10	10%
5.	Final examination (practical)	15	20%
6.	Final examination (Theory)	16	40%
	TOTAL	100%	

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	<ul style="list-style-type: none"> - Environmental Biotechnology: Principles and Applications, Second Edition 2nd Edition by Bruce Rittmann (Author), Perry McCarty (Author). - Environmental Biotechnology: Basic Concepts and Applications by Viswanath Buddolla (Author). - Environmental Biotechnology :Edition 2nd Author Daniel Vallero. <p>Text book; Actinobacteria - Basics and Biotechnological Applications, Dharumadurai Dhanasekaran and Yi ,Jiang, InTech, 2016, ISBN 978-953- 51-2248-7</p> <ul style="list-style-type: none"> - Book Title: Bioremediation of Environmental Pollutants Author: Alaa El-Din Bayoumi Abdel Khaleq Year: 1441,
Supportive References	<ul style="list-style-type: none"> - Journal of Petroleum & Environmental Biotechnology - Journal of Biotechnology - Microbial ecology and environmental biotechnology
Electronic Materials	Environmental Science. ALISON – online learning website. https://alison.com/courses?query=environmental%20science
Other Learning Materials	Environmental biotechnology



https://journals.plos.org/plosone/browse/environmental_biotechnology

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	<ul style="list-style-type: none"> - Lecture room = 30 students - Laboratory for practical = 15 students
Technology equipment (projector, smart board, software)	<ul style="list-style-type: none"> - Computers - Internet access - Smart Board (preferred) - Projector
Other equipment (depending on the nature of the specialty)	<ul style="list-style-type: none"> - Display screen - White board - SDS electrophoresis tanks and its contents - DNA electrophoresis tanks and its contents - PCR Thermocycler - UV rays for DNA visualization

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	<ul style="list-style-type: none"> ➤ Class discussion. ➤ Written feedback by individuals. ➤ Satisfaction survey at the end of each semester.
Effectiveness of Students assessment	Course instructor Peer reviewer Program director	<ul style="list-style-type: none"> ➤ Course development according to the analysis of student feedback. ➤ Monitoring students' performance throughout the semester using formative assessment. ➤ Analyzing students' progress. ➤ Using statistics to analyze students' achievement at the end of each semester and implement data comparison. ➤ Department council discussion. ➤ Peer evaluation of the instructor.
Quality of learning resources	Course instructor	<ul style="list-style-type: none"> ➤ Attending staff development workshops and programs. ➤ Continuous education. ➤ Implementing student feedback.



Assessment Areas/Issues	Assessor	Assessment Methods
		➤ Variations of teaching strategies including tutorials, PBL and more emphasizing on the practical sessions
The extent to which CLOs have been achieved		
Other		

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)

Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify))

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Umm Al-Qura University Council
851141114462/190635 NO.	851141114462/190635
DATE	22/11/1446

