Course Specification
(Bachelor)

Course Title:	Environmental Biotechnology
Course Code:	EVS 1240
Program:	Bachelor of Science in Environmental Science
Department:	Biology
College:	Science
Institution:	Imam Mohammed Ibn Saud Islamic University
Version:	1
Last Revision Date:	-

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: 3(Lectures 2 + Lab 2)				
2. Course type				
A.	☐University	☐College	☒ Department	☐ Track
B.	☒ Required		☐ Elective	
3. Level/year at which this course is offered: (Level 4/ 2nd Year)				

4. Course General Description:

This postgraduate course provides the candidates with a comprehensive understanding of the theoretical foundations, practical skills, and applications of Environmental Biotechnology. Welcome to the environmental Biotechnology course, where cutting-edge science meets the world of biotechnology. This course is designed to provide a comprehensive exploration of the principles and applications of biotechnology in Environmental sciences, aiming to equip students with the knowledge and skills needed to address the challenges and opportunities in the rapidly evolving field. From understanding the fundamentals of molecular biology and genetics to exploring advanced genetic engineering techniques, we delve into the intricate mechanisms that govern plant and microbial life. The course will cover the ethical, legal, and social dimensions of environmental biotechnology, ensuring a well-rounded perspective. As we navigate the landscape of genetic modification, plant breeding, and microbial biotechnology, we also examine the crucial role of biotechnology in enhancing crop yield, nutritional content, and overall food security. Through a blend of theoretical knowledge and hands-on laboratory experiences, students will gain practical insights into the world of Environmental biotechnology and its transformative impact on sustainable farming practices. Get ready to embark on a journey that merges scientific innovation with the imperative of feeding a growing global population.

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

EVS 1110

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

None

7. Course Main Objective(s):

The objective of this course is to provide the students with a comprehensive understanding of the theoretical foundations, practical skills, and applications of bioinformatics in the field of molecular biology and genomics. Through a combination of lectures, hands-on exercises, and projects, students will acquire various knowledge and skills.

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	√	100 %
2	E-learning	-	-
3	Hybrid • Traditional classroom • E-learning	-	-
4	Distance learning	-	-

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	30
3.	**Field**	4
4.	**Tutorial**	0
5.	**Others (specify) .....**	0
	Total	60

B. Course Learning Outcomes, Teaching Strategies, Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**Describe the fundamental principles and concepts of environmental biotechnology.**	**K1**	Two credits weekly lectures	-Quizzes -Presentations -Assignments -written exams
1.2	**Explain the roles of microorganisms in environmental processes and their applications in biotechnology.**	**K2**	Two credits weekly lectures	Quizzes -Presentations -Assignments -written exams
1.3	**Outline the mechanisms and techniques used in bioremediation, waste treatment, and pollution control.**	**K3**	Two credits weekly lectures	Quizzes -Presentations -Assignments -written exams
2.0	Skills			
2.1	**Analyze and interpret data from environmental biotechnology experiments and studies.**	**S1**	-Two credits weekly lectures -Tutorials	-Presentations -Assignments -written exams
2.2	**Evaluate critically the potential benefits, limitations, and risks associated with environmental biotechnology applications.**	**S2**	-Two credits weekly lectures -Tutorials	-Presentations -Assignments -written exams
2.3	**Formulate strategies for sustainable environmental management using biotechnological approaches.**	**S3**	-Two credits weekly lectures -Tutorials	-Presentations -Reports
3.0	Values, autonomy, and responsibility			
3.1	**Show independence and responsibility and cooperate effectively in a team to carry out research work**	**V1**	Group discussions	-Presentations -Reports

Code	Course Learning Outcomes	Code of CLOs aligned with the program	Teaching Strategies	Assessment Methods
3.2	**Share in the discussion of scientific issues and present research results via oral presentations and in written format.**	**V2**	Group discussions	-Presentations -Reports

C. Course Content:

No	List of Topics	Contact Hours
1.	**Introduction to Environmental Biotechnology:** Overview of Environmental biotechnology and its applications. Environmental issues and the role of biotechnology Principles of microbiology and cell biology	4
2.	**Bioremediation and Waste Treatment** Principles and mechanisms of bioremediation Bioremediation of soil, water, and air pollutants Biological treatment of solid and liquid wastes	4
3.	**Microbial Ecology and Biodiversity** Study of microbial communities and their roles in ecosystems Microbial interactions and ecosystem functions Biodiversity and its importance in environmental biotechnology	4
4.	**Biomass and Bioenergy** Biomass sources and conversion technologies Biofuels production (bioethanol, biodiesel, biogas) Biorefinery concepts and sustainability	4
5.	**Bioremediation and Waste Treatment:** Principles and mechanisms of bioremediation Bioremediation of soil, water, and air pollutants Biological treatment of solid and liquid wastes	4
6.	**Environmental Biotechnology:** Bioremediation and phytoremediation. Biotechnology for sustainable agriculture. Genetic modification for environmental benefits.	4

7.	**Environmental Biotechnology Applications:** Biotechnology in wastewater treatment Biomonitoring and biosensors Bioleaching and biomining Biodegradation of xenobiotics and recalcitrant compounds	4
8	**Biotechnology and Sustainable Development:** Biotechnology for sustainable agriculture Green chemistry and clean technologies Bioethics and biosafety considerations	2
Total		**30**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm 1	Around 4th - 5th week	15%
2.	Midterm 2	Around 7th - 8th week	15%
3.	Quizzes, Participation, and Attendance	During the semester	10%
4.	Lab reports	During the semester	5%
5.	Lab Exam	15th week	15%
6.	Final Exam	16th week	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	*Rittmann, B.E. and McCarty, P.L. (2020) Environmental Biotechnology: Principles and Applications. 2nd edn. New York: McGraw-Hill Education.*

	Singh, J.S., Singh, D.P. and Pandey, V.C. (2017) Environmental Biotechnology: Theory and Applications. Boca Raton: CRC Press. Desai, C., Pathak, H. and Madamwar, D. (2010) 'Advances in molecular and "-omics" technologies to gauge microbial communities and bioremediation at xenobiotic/anthropogen contaminated sites', Bioresource Technology, 101(6), pp. 1558-1569. Book Chapters: Martínez-Toledo, A., Rodríguez-Vázquez, R. and Garzón-Zúñiga, M.A. (2017) 'Environmental Biotechnology', in Singh, R.L. and Singh, P.K. (eds.) Introduction to Environmental Biotechnology. Singapore: Springer, pp. 1-22. Singh, J.S. and Singh, D.P. (2012) 'Decontamination of environmental pollutants using naturally occurring and genetically engineered microorganisms', in Singh, S.N. (ed.) Environmental Biotechnology. New Delhi: APH Publishing Corporation, pp. 93-116. These references cover various aspects of environmental biotechnology, including principles, applications, bioremediation, genetically engineered organisms, and molecular techniques, providing a comprehensive overview of the field.
Supportive References	For an Environmental Biotechnology course, there are several reputable online resources that cover a wide range of topics in the field. Here are some valuable online resources that you may find useful: 1. **National Center for Biotechnology Information (NCBI)** • Website: NCBI • NCBI provides access to a vast collection of biological databases, including GenBank and PubMed, which can be valuable for researching genetic information and scientific literature. 2. **International Service for the Acquisition of Agri-biotech Applications (ISAAA)** • Website: ISAAA • ISAAA is a global organization that provides information on biotechnology applications in

	agriculture, including biotech crop statistics and publications. 3. **The World of Genetically Modified Organisms (GMOs) - BIO** • Website: GMO Answers • GMO Answers, by the Biotechnology Innovation Organization (BIO), offers information on genetically modified organisms (GMOs) in agriculture, addressing common questions and concerns. 4. **FAO Biotechnology Forum** • Website: FAO Biotechnology Forum • The Food and Agriculture Organization (FAO) Biotechnology Forum provides information on the use of biotechnology in agriculture, including discussions, documents, and expert opinions. 5. **Genetic Literacy Project** • Website: Genetic Literacy Project • The Genetic Literacy Project provides articles and resources on genetics, biotechnology, and related topics, aiming to promote scientific literacy. 6. **AgBioForum** • Website: AgBioForum • AgBioForum is an international, peer-reviewed journal that publishes research on the economic, social, and environmental aspects of Environmental biotechnology. 7. **BioTech Primer** • Website: BioTech Primer • BioTech Primer offers online courses and resources covering various biotechnology topics, including those related to agriculture. 8. **United States Department of Agriculture (USDA) Biotechnology Resources** • Website: USDA Biotechnology • The USDA provides resources on biotechnology, including regulations, policies, and information on biotech crops.
Electronic Materials	
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	**Classroom**
Technology equipment (Projector, smart board, software)	**Projector, smart board**
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect
Effectiveness of students assessment	Program leader	Direct
Quality of learning resources	Peer Reviewer	Direct
The extent to which CLOs have been achieved	Program leader	Direct
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	