

Course Specification

— (Postgraduate Programs)

Course Title: Agricultural Biotechnology
Course Code: BIO-6332
Program: Master of Science in Applied Biology (Industrial and Environmental Biotechnology & Sustainability)
Department: Biology
College: Science
Institution: Imam Mohammad Ibn Saud Islamic University
Version: 1
Last Revision Date: <i>Pick Revision Date.</i>

Approval Data:.....

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A. General information about the course:

1. Course Identification:

1. Credit hours: 3(Lecture 2+ Lab 2)

2. Course type

A. ☐ University ☐ College ☐ Department ☒ Track

B. ☒ Required ☐ Elective

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

4. Course General Description:

This postgraduate course provides the candidates with a comprehensive understanding of the theoretical foundations, practical skills, and applications of Agricultural biotechnology. Welcome to the Agricultural Biotechnology course, where cutting-edge science meets the world of farming and cultivation. This course is designed to provide a comprehensive exploration of the principles and applications of biotechnology in agriculture, 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 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 agricultural 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):

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

7. Course Main Objective(s):

The objective of this course is to provide the students with a 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.	Tutorial	
5.	Others (specify)	
	Total	60

B. Course Learning Outcomes, Teaching Strategies, Assessment Methods



Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Demonstrate a comprehensive understanding of the fundamental principles of biotechnology, molecular biology, and genetics, and their relevance to agriculture.		Two credits weekly lectures	-Quizzes -Presentations -Assignments -written exams
1.2	Understand and navigate the regulatory frameworks governing the development, testing, and release of genetically modified organisms (GMOs) in agriculture.		Two credits weekly lectures	Quizzes -Presentations -Assignments -written exams
1.3	Understand the role of microorganisms in agriculture, and microbial biotechnology techniques to enhance soil health, nutrient cycling, and plant growth.		Two credits weekly lectures	Quizzes -Presentations -Assignments -written exams
2.0	Skills			
2.1	Apply genetic engineering techniques, such as recombinant DNA technology and genome editing, to manipulate the genetic makeup of organisms for agricultural purposes.		-Two credits weekly lectures -Tutorials	-Presentations -Assignments -written exams
2.2	Analyze and apply principles of plant genetics and breeding to develop improved crop varieties with desirable traits, considering factors such as yield, resistance to pests and diseases, and environmental adaptability.		-Two credits weekly lectures -Tutorials	-Presentations -Assignments -written exams
2.3	Critically Evaluate the role of microorganisms in agriculture, and apply microbial biotechnology techniques to enhance soil health, nutrient cycling, and plant growth.		-Two credits weekly lectures -Tutorials	-Presentations -Reports



Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
3.0	Values, autonomy, and responsibility			
3.1	Show independence and responsibility and cooperate effectively in a team to carry out research work		Group discussions	-Presentations -Reports
3.2	Discuss the scientific issues and present research results via oral presentations and in written format.		Group discussions	-Presentations -Reports

C. Course Content:

No	List of Topics	Contact Hours
1.	Introduction to Biotechnology: Overview of biotechnology and its applications in agriculture. Historical development of biotechnology in agriculture. Basic principles of molecular biology and genetics.	4
2.	Plant Genetics and Breeding: Principles of plant genetics. Techniques in plant breeding. Genetic modification and its role in crop improvement.	4
3.	Microbial Biotechnology: Role of microorganisms in agriculture. Microbial genetics and genetic engineering. Applications of microorganisms in crop production and soil health.	3
4.	Genetic Engineering Techniques: Recombinant DNA technology. Gene cloning and expression. Genome editing techniques (e.g., CRISPR-Cas9).	3
5.	Biotechnology in Crop Improvement:	3

	Development of genetically modified (GM) crops. Traits introduced in GM crops (e.g., pest resistance, herbicide tolerance). Regulation and safety considerations in GM crop development.	
6.	Environmental Biotechnology: Bioremediation and phytoremediation. Biotechnology for sustainable agriculture. Genetic modification for environmental benefits.	3
7.	Biotechnology and Food Security: Role of biotechnology in addressing global food security. Biotechnological approaches to enhance crop yield and nutritional content.	2
8.	Emerging Trends in Agricultural Biotechnology: Nanotechnology in agriculture. Synthetic biology applications. Precision agriculture and data-driven farming.	2
Total		30

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm exam-1	5 th week	15%
2.	Midterm exam-2	10 th week	15%
3.	Assignments, presentations, attendance, data search, participation	Throughout the course duration	10%
1.	Final lab exam	15 th week	20%
4.	Final exam	16 th week	40%

*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	<i>Srividhya Venkataraman, Kathleen Hefferon (2023). Agricultural Biotechnology. Elsevier; 2023. doi: 10.1016/C2020-0-00515-3.</i>
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(<https://www.sciencedirect.com/science/article/pii/B9780323884761010018>)

1. Tyczewska A, Twardowski T, Woźniak-Gientka E. *Agricultural Biotechnology for Sustainable Food Security*. Vol 41.; 2023. Accessed January 25, 2024.

<https://www.sciencedirect.com/science/article/pii/S0167779922003419>

Qaim M. *Genetically Modified Crops and Agricultural Development*. Palgrave Macmillan US; 2016. doi:[10.1057/9781137405722](https://doi.org/10.1057/9781137405722)

Wünschiers, R. (2013). *Computational biology: A practical introduction to biodata processing and analysis with Linux, MySQL, and R* (Second edition). Springer.

For an Agricultural 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](https://www.isaaa.org)
- 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](https://www.gmoanswers.org)
- 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](https://www.geneticliteracyproject.org)

Supportive References

	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 agricultural 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	Faculty	Direct
Quality of learning resources	Faculty	Direct
The extent to which CLOs have been achieved	Faculty	Direct
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

-	BIOLOGY DEPARTMENT COUNCIL
REFERENCE NO.	23
DATE	23/8/1445

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