Course Specification

(Postgraduate Programs)

Course Title:	**Industrial Microbiology 2**
Course Code:	**BIO-6334**
Program:	**Master of Science in Applied Biology (Industrial and Environmental Biotechnology)**
Department:	**Biology**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**1**
Last Revision Date:	*Pick Revision Date.*

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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:

In this course, we will highlight some of the natural microbial metabolic pathways that produce compounds of high economic value, making it feasible to employ these organisms in bioreactors to produce these compounds "valuable biomolecules" such as antibiotics, enzymes that catalyze reactions and antibodies that target specific antigens, opening doors to countless industrial and medical uses.
also, we will discuss Harness the power of microbial fuel cells: Discover how microbes can generate electricity, paving the way for a greener future powered by these miniature powerhouses. and Dive into the science behind bioethanol production, understanding how microorganisms transform biomass into a sustainable fuel alternative. Cultivation of green energy from microalgae. we will Explore the potential of microalgae as a biofuel source, unlocking the power of photosynthesis for a cleaner and greener future.
one of this course scopes is Empower agriculture with microbial solutions or discover how microbes can be our allies in sustainable agriculture, improving soil health, enhancing crop yields, and protecting food after harvest.
This course also deals with biological methods for extracting minerals by biofiltration. This provides a less environmentally harmful alternative to traditional mining methods.

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

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

7. Course Main Objective(s):

- Explore the diverse applications of industrial microbiology beyond food production, delving into the fascinating world of microbial metabolic pathways and their potential for innovative solutions.
- Gain comprehensive knowledge of how physiological and genomic principles govern the production of valuable biomolecules like enzymes and antibodies by microorganisms.
- Evaluate the potential of microbial fuel cells as a sustainable energy source, analyzing their technological advancements and future implications.
- Critically assess the feasibility and environmental impact of bioethanol production using diverse microbial resources.

- Investigate the potential of microalgae as a renewable biofuel source, considering current challenges and future opportunities in this emerging field.
- Discover and analyze the multifaceted ways microorganisms can contribute to sustainable agriculture practices and post-harvest food protection.
- Understand the principles and applications of bioleaching as a cleaner alternative to traditional metal extraction methods, evaluating its environmental benefits and limitations.

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	Gain a deep understanding of the physiological and genomic principles underlying various industrial microbiology applications.		Two credits weekly lectures	-Quizzes -Presentations -Assignments -written exams
1.2	Master the science behind the production of important biomolecules like enzymes and antibodies by microorganisms.		Two credits weekly lectures	Quizzes -Presentations -Assignments -written exams
1.3	Analyze the principles and potential of microbial fuel cells and their role in sustainable energy generation.		Two credits weekly lectures	Quizzes -Presentations -Assignments -written exams
1.4	Comprehend the biological processes involved in bioethanol production and evaluate its economic and environmental implications.		Two credits weekly lectures	Quizzes -Presentations -Assignments -written exams
1.5	Explore the potential of microalgae as a renewable source of biofuel and analyze the current challenges and opportunities in this field.		Two credits weekly lectures	Quizzes -Presentations -Assignments -written exams

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.6	Evaluate the diverse microbial solutions that contribute to sustainable agriculture practices and post-harvest food protection.		Two credits weekly lectures	Quizzes -Presentations -Assignments -written exams
1.7	Understand the principles and applications of bioleaching as a more environmentally friendly approach to metal extraction.		Two credits weekly lectures	Quizzes -Presentations -Assignments -written exams
2.0	Skills			
2.1	Develop critical thinking and problem-solving skills to analyze data, propose solutions, and address challenges in different industrial microbiology applications.		-Two credits weekly lectures -Tutorials	-Presentations -Assignments -written exams
2.2	Design and interpret experiments related to microbial growth, biomolecule production, and energy generation.		-Two credits weekly lectures -Tutorials	-Presentations -Assignments -written exams
2.3	Effectively communicate complex scientific concepts and technological advancements in industrial microbiology to diverse audiences.		-Two credits weekly lectures -Tutorials	-Presentations -Reports
2.4	Stay updated with the latest research and developments in the field through scientific literature and professional resources. Apply theoretical knowledge to solve practical problems		-Two credits weekly lectures -Tutorials	-Presentations -Reports

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	encountered in industries utilizing industrial microbiology techniques.			
3.0	Values, autonomy, and responsibility			
3.1	**Values** Sustainability and Environmental Stewardship: Instill a strong commitment to using industrial microbiology practices that minimize environmental impact, conserve resources, and promote renewable solutions. Social Responsibility and Equity: Encourage students to consider the broader societal implications of their work, ensuring equitable access to the benefits of industrial microbiology advancements and addressing potential ethical concerns. Scientific Integrity and Transparency: Foster a culture of ethical research and development, promoting data integrity, transparency in communication, and responsible use of scientific knowledge.		Group discussions	-Presentations -Reports
3.2	**Autonomy**: Critical Thinking and Innovation: Challenge students to go beyond established practices, encouraging them to critically analyze current applications, propose innovative		Group discussions	-Presentations -Reports

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	solutions, and contribute to the advancement of the field. Lifelong Learning and Professional Development: Cultivate a passion for continuous learning, encouraging students to stay updated with the latest research, developments, and ethical considerations in industrial microbiology. Independent Research and Problem-Solving: Provide opportunities for students to conduct independent research projects, analyze data, and develop solutions to real-world challenges presented by industrial microbiology applications. Effective Communication and Collaboration: Enhance communication skills to convey complex scientific concepts to diverse audiences, fostering collaboration and knowledge exchange within the field.			
3.3	**Responsibility**: Risk Assessment and Management: Emphasize the importance of identifying and mitigating potential risks associated with various industrial		Group discussions	-Presentations -Reports

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	microbiology applications, ensuring safety for humans, animals, and the environment. Ethical Research and Development: Promote responsible research practices and ethical considerations in the development and implementation of new industrial microbiology technologies. Resource Management and Optimization: Foster an awareness of the resource demands of different industrial microbiology applications, encouraging efficient resource utilization and minimizing waste generation. Public Engagement and Transparency: Encourage students to engage with the public, addressing concerns, providing transparent information about their work, and promoting responsible uses of industrial microbiology.			

C. Course Content:

No	List of Topics	Contact Hours

1	Physiological and genomic principles behind applications of industrial microbiology	4
2	Important Biomolecules Production , enzymes and antibodies.	6
3	Microbial fuel cell (MFC) applications	2
4	Bioethanol production	2
5	Biofuel from micro algae	2
6	Microbial products for Sustainable Agriculture and Post-Harvest Food Protection	6
7	Bioleaching " biomining".	2
Total		**30**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Midterm exam-1**	5th week	15%
2.	**Midterm exam-2**	10th week	15%
3.	**Assignments, presentations, attendance, data search, participation**	Throughout the course duration	10%
	Final lab exam	15th week	20%
4.	**Final exam**	16th 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	1- David Wilson., Hermann Sahm., Peter Stahmann and Mattheos Koffas . 2019. Industrial Microbiology. Wiley-VCH. 2- Zvi Cohen and Colin Ratledge. 2010. Single Cell Oils, Microbial and Algal Oils. Academic Press and AOCS Press. 3- Venkataraman S., Prabhakaran M and Kiyoshi O. 2018. Microbial Fuel Cell Technology for Bioelectricity. Singapore : Springer 4- Johnson B.D., Bryan C.G., Schlömann M and Roberto. F. 2023. Biomining Technologies, Extracting and Recovering Metals from Ores and Wastes. Singapore : Springer.
Supportive References	
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**