Course Specification
(Bachelor)

Course Title: Genetic Engineering and Biotechnology
Course Code: BIO 1333
Program: Bachelor of Science in Biology
Department: Biology
College: Science
Institution: Imam Mohammad Ibn Saud Islamic University
Version: 1
Last Revision Date: -

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: 4 (3 Lectures + 2 Laboratory + 0 Tutorials)					
2. Course type					
A.	☐University	☐College	☐Department	☐Track	Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (Level 6 / 3rd Year)					
4. Course General Description:					
This course provides the basic necessary knowledge of genetic engineering and biotechnology principles, techniques, and applications. The course topics covers recombinant DNA technology, cloning strategies, gene expression systems, genome editing. The course content also emphasizes the biotechnological applications in the fields of medicine, agriculture, and industry. The offered practical sessions reinforce the theoretical concepts by the mean of hands-on experience in the aforementioned techniques.					
5. Pre-requirements for this course (if any)**:**					
BIO 1231 BIO 1232					
6. Co-requisites for this course (if any)**:**					
None.					
7. Course Main Objective(s):					
This course aims to provide students with the fundamental concepts, principles, techniques, and applications of genetic engineering and biotechnology. The students will have the chance to get acquainted with recombinant DNA technology, cloning strategies, gene expression systems, and genome editing tools such as CRISPR. The course emphasizes the biotechnological advancements in the areas of medicine, agriculture, industry, and environmental science, including the production of recombinant proteins, genetically modified organisms, and biopharmaceuticals. Additionally, students will gain insights into the fermentation biotechnology and the industrial production of enzymes, with an emphasis on the related wide-scale bioprocesses and microbial systems. Ethical considerations, biosafety regulations, and **societal impacts of genetic engineering are the** course topics that ensure the reasonable applications of biotechnology in real life situations.					

Through a combination of accurately selected lectures and laboratory work, students will the opportunity to develop critical thinking skills, practical expertise, and the ability to employ the biotechnological concepts to solve the existing problems in the relevant work fields.

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**	45
2.	**Laboratory/Studio**	30
3.	**Field**	0
4.	**Tutorial**	0
5.	**Others (specify)**	0
Total		75

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	Explain the fundamental principles of genetic engineering and biotechnology, including recombinant DNA technology,	K1	Lecture Take-home assignments Group discussions	Quizzes Exams Participations Attendance

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	cloning, and gene expression systems.			
1.2	Describe the genome editing techniques such as CRISPR-Cas9 and their applications in medicine, agriculture, and industry.	K1—K2	Lecture and take-home research assignment	Quizzes Exams Participations Attendance
1.3	Identify the key industrial biotechnological processes, including enzyme production and fermentation technology.	K2-K3	Lecture and take-home research assignment	Quizzes Exams Participations Attendance
2.0	**Skills**			
2.1	Perform the basic molecular biology techniques, including DNA extraction, PCR, and bacterial transformation.	S1	Laboratory and take-home research assignment	Lab reports and Lab exam
2.2	Design and optimize the cloning strategies using appropriate vectors and host systems.	S2	Laboratory and take-home research assignment	Lab reports and Lab exam
2.3	Employ the critical thinking and skills to Troubleshoot and solve the technical problems encountered during conducting lab work related to genetic engineering and biotechnology	S1-S3	Laboratory and take-home research assignment	Lab reports and Lab exam
3.0	**Values, autonomy, and responsibility**			
3.1	Show independency to accomplish the assigned tasks and cooperate effectively in multidisciplinary teams	V1	Ethics case studies, discussions on bioethics	Lab reports, project presentations, Lab exam

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
3.2	Share in the discussion of genetic engineering and biotechnology issues and communicate scientific data professionally as oral presentation and written format.	V2	Collaborative group projects and teamwork exercises	Lab reports, project presentations
3.3	Demonstrate ethical responsibility in genetic engineering practices, including the biosafety and regulatory compliance.	V2-V3	Collaborative group Discussions	Lab reports, project presentations

C. Course Content

No	List of Topics (Lectures)	Contact Hours
1.	Introduction to Genetic Engineering and Biotechnology	3
2.	Tools of Genetic Engineering-I (Enzymes).	6
3.	Tools of Genetic Engineering-II (Vectors).	6
4.	Recombinant DNA Technology-I (purification techniques and cloning strategies).	3
5.	Recombinant DNA Technology-II (Construction of gene libraries).	3
6.	Polymerase Chain Reaction (PCR)	6
7.	Gene Editing and CRISPR Technology	3
8.	Genetic Engineering in Medicine	3
9.	Agricultural Biotechnology	3
10.	Industrial Enzymes and Fermentation Biotechnology	3
11.	Ethical, Legal, and Social Issues in Genetic Engineering	3
12.	General revision	3
	Total	45

No	List of Topics (Labs)	Contact Hours
1.	Tissue culture-I	2
2.	Tissue culture-II	2
3.	DNA Extraction	4
4.	Agarose gel electrophoresis	2

5.	Polymerase Chain Reaction (PCR)	4
6.	Bacterial transformation and plasmid isolation	2
7.	Hybridization	2
8.	Restriction enzymes	4
9.	Enzyme production using microbial fermentation	2
10.	Genetically Modification Organisms (GMOs)	2
11.	Genetic Firngerprint	2
12.	Biological Database	2
Total		30

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	First Semester Exam	5th week	15%
2.	Second Semester Exam	10th 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	Nicholl, D. S. T. (2023). An Introduction to Genetic Engineering (4th ed.). Cambridge University Press. Glick, B. R., Pasternak, J. J., & Patten, C. L. (2017). Molecular Biotechnology: Principles and Applications of Recombinant DNA (5th ed.). ASM Press. ISBN: 978-1-55581-968-2.
Supportive References	Brown, T. A. (2020). Gene Cloning and DNA Analysis: An Introduction (8th ed.). Wiley-Blackwell. ISBN: 978-1-119-64957-4.
Electronic Materials	
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms and Laboratories
Technology equipment (projector, smart board, software)	Projector and Smart board
Other equipment (depending on the nature of the specialty)	Biotechnology-related instruments, including safety cabinet, centrifuges, incubators, light microscopes, spectrophotometers, microplate reader.

F. Assessment of Course Quality

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

Assessors (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	HEAD OF BIOLOGY DEPARTMENT
REFERENCE NO.	
DATE	