

Course Specification

— (Postgraduate Programs)

Course Title: Techniques in Cell and Molecular Biology
Course Code: BIO-6202
Program: Master of Science in Applied Biology (Cell and Molecular Biology)
Department: Biology
College: Science
Institution: Imam Mohammad Ibn Saud Islamic University
Version: 1
Last Revision Date: <i>Pick Revision Date.</i>



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A. General information about the course:

1. Course Identification:

1. Credit hours: (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 2 / first year)

4. Course general Description:

This graduate course provides the students with the principal and practical applications of both conventional and modern techniques in cell and molecular biology. The course covers a variety of topics of interest to students who study and do research work in the area of molecular biology as well as cell-related issues. Practical skills in fundamental techniques such as DNA and RNA extraction, quantification and electrophoresis are focused in this course. Through the course study, the student's lab skills are upgraded to encompass the advanced relevant techniques including standard Polymerase chain reaction (PCR), primer design and real-time PCR. The course emphasizes experimental design, execution, and data analysis. The acquired knowledge and skills enable the students to perform research work independently and share in collaborative projects culminating in a comprehensive understanding of fundamental methodologies in molecular biology. Upon successful completion of the course, the students become competent to contribute professionally in the disciplines of molecular biology.

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

None

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

None

7. Course Main Objective(s):

This course is designed to equip students with a set of recognizable skills and knowledge to conduct impactful molecular biology research. Starting with an acquaintance of introductory techniques such as DNA and RNA extraction and quantification, students progressively manage to master complex methodologies such as polymerase chain reaction (PCR) and real-time PCR. The course aims to build up student ability in experimental design, execution, and data analysis; and simultaneously strengthens students' capability to independently or collaboratively undertake projects within a research context. Through hands-on experience with modern laboratory equipment, students will develop a robust understanding of the practical applications and significance of molecular biology in scientific exploration.



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	0
5.	Others (specify).....	
	Total	60

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

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Outline the principles of nucleic acids extraction and quantification methods.	K1	-Lab demonstrations -Tutorials -Guided hands-on practice	-Active participation in lab discussions. -Lab reports -lab exam

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.2	Describe the advanced molecular biology techniques, such as PCR and real-time PCR, and identify the necessary lab equipment.	K2	-Lab demonstrations -Tutorials -Guided hands-on practice	-Active participation in lab discussions. -Lab reports -Lab exam
1.3	Explain the considerations and list the essential tools related to primer design.	K3	-Lab demonstrations -Tutorials	-Active participation in lab discussions. -Lab reports -Lab exam
2.0	Skills			
2.1	Employ hands-on skills to conduct experimental work in molecular biology using the proper methods and techniques.	S1	-Guided Lab work -Lab tutorials	-Direct observations -Lab reports -Lab exam
2.2	Design experimental work and relate the theoretical knowledge to the applicable methodology as a mode of carrying out professional research work.	S2	-Guided lab experiments -Group discussions	-Lab reports -Presentations
2.3	Evaluate, interpret, and analyze the results of molecular research using the appropriate analytical methods.	S3	-Guided analysis of research data -Group discussions	-Lab reports -Presentations
3.0	Values, autonomy, and responsibility			
3.1	Show independence in performing lab work and collaborating effectively in teamwork.	V1	-Monitored lab research work -Group discussions	-Lab reports -Presentations by research groups
3.2	Participate in the discussions of specialized molecular issues, and present scientific data professionally as oral	V2	-Tutorials on presenting research data -Seminars -Group discussions	-Active participation -Presentations



Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	presentations as well as in written format			
3.3	Practice the ethical conduct of research and follow the approved research principles.	V3	-Tutorials on research ethics and principles	-Lab reports

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C. Course Content:

No	List of Topics	Contact Hours
1.	Introduction to Molecular Biology Laboratory: -Solution preparation and dilution -Pipetting	2
2.	Genomic DNA Extraction: -Phenol Chloroform Extraction -DNA Extraction Kits	2
3.	RNA Extraction: -RNA Isolation with Extraction Kits.	2
4.	DNA and RNA quantification by Spectrophotometric Assay: -Determination of DNA Purity and Concentration by Spectrophotometric Assay.	2
5.	Electrophoresis: -Separation of DNA Fragments in Agarose Gel	2
6.	Primer Design: -General Considerations in Primer Design. -Web-Based Tools for Primer Design.	2
7.	Polymerase Chain Reaction (PCR) Optimization: -Principles of PCR -Amplification of a target gene. -Gel electrophoresis to analyze PCR products	4
8.	RNA Extraction and Reverse Transcription: -RNA extraction from cells with Trizol Reagent -Reverse transcription of RNA to cDNA.	2
9.	Real-time PCR (qPCR): -Principles of real-time PCR -Designing qPCR primers and probes	4



	-Setting up a qPCR reaction.	
10.	Analysis of qPCR data and quantification of target gene expression: -Absolute and relative quantification - $2^{-\Delta\Delta CT}$.	2
Total		30

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm exams	5 th and 10 th weeks	30 %
2.	Quizzes, presentations, lab reports, participation, attendance, data search, assignments	Throughout the semester duration	10 %
	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	Wilson K., Walker J. (2018). Principles and Techniques of Biochemistry and Molecular Biology. 8 th Edn. Cambridge University Press.
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.)	Well-equipped lab
Technology equipment (Projector, smart board, software)	Projector and smart board

Items	Resources
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