Lahore University of Management Sciences

Bio 100 –Biology Laboratory

Spring 2024

Instructor	Dr. M .Tariq, Dr. Khurram Bashir, Dr. Zaigham Shahzad (lead)
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Secretary/TA	Ms. Khalida Mazhar
TA Office Hours	To be decided
Course URL (if any)	lms.lums.edu.pk
Lecture	In Person
Lab	On hands practical Lab

Course Teaching Methodology (Please mention following details in plain text)

- **Teaching Methodology:** All lectures will be delivered on campus however students will be guided to supplementary reading material.
- **Lecture Details:** There will be no pre-recorded lectures. However, links to related reference material available online from different sources will be provided, if necessary.

Course Basics				
Credit Hours	1			
Lecture(s)	Nbr of Lec(s) Per Week	1	Duration	1 hr
Recitation/Lab (per week)	Nbr of Lec(s) Per Week	1	Duration	4 hrs
Tutorial (per week)	Nbr of Lec(s) Per Week		Duration	

Course Distribution	
Core	SSE Core
Elective	NA
Open for Student Category	Freshmen, Sophomore, Juniors, Seniors
Close for Student Category	None

COURSE DESCRIPTION

This laboratory based course will introduce students to basic concepts in molecular biology and genetic engineering. The major emphasis will be on lab based experiments designed to give hands on training in different techniques used in a molecular biology lab to amplify and clone a gene as well as use of these tools in forensic analysis. In addition, students will visualize various stages of dividing cells under microscope and will be exposed to cell culture used in cell biology. Students will also be exposed to bioinformatics (*in silico* biology) and its use in big data analysis and computation. The major goal is to give a clear understanding of experimental design and how data must be analyzed with all minor details visible in an experimental picture. Reading material and lab manual will be available on LMS. Introduction to each module and experimental protocol will be provided in the beginning of each module in the form of a short pre-lab lecture

COURSE PREREQUISITE(S)

• • •	None

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COURSE OBJECTIVES	
	• The basic objective of this lab based course is to introduce students to: • Molecular tools used in gene cloning and gene expression in a very basic cloning module. • Bioinformatics (in silico biology) which should enable an independent analysis. • Molecular tools used in modern day disease diagnostics and forensic analysis. • Detailed data recording, analysis and interpretation as well as ethical behavior while handling data or working in a laboratory

Learning Outcomes	
	At the end of the lab students must have clear understanding of following concepts, tools and their use in the lab: • CLO1: Ethical behavior and responsibilities of a scientist in particular working in a bio lab • CLO2: How to amplify a gene and clone in a vector, transformation and selection of transformants. • CLO3: How to isolate plasmid DNA and analyze using RFLP. • CLO4: Simple and Compound microscopes: How Bacteria can be visualized using Compound microscopes • CLO5: Bioinformatics: in silico analysis of genomes and their application in medicine • CLO6: How molecular biology is being used in forensic studies • CLO7: Need to maintain lab notebook, detailed data recording, analysis and interpretation.

Grading break up: Component Details and weightages
Lab Notebook: 30% Attendance + Lab Performance: 10% Assignment :10% Final exam: 50%

Examination Detail	
Midterm Exam	Yes/No: Combine Separate: No Duration: No Preferred Date: No Exam Specifications: No
Final Exam	Yes/No: Yes Duration: 120~180 mins (May vary if taken online) Exam Specifications: Closed Book, No Calculator. No cell phones.

COURSE OVERVIEW

Week/ Lecture/ Module	Topics	Recommended Readings	Objectives/ Application
Week 1: Bioinformatics	Bioinformatics (BLAST & Concept of homology modelling) Computer lab above Library.	Manuals	CLO5, CLO7
Week 2: Introduction to	1. Introduction to biology lab & its objectives (Course contents, good lab practices, writing lab report & maintaining notebooks. why are we doing this Lab?)	Manuals	CLO1, CLO7

the lab	(40min) 2. Media prep (LB media & agar) (30min) • Students will prepare media by mixing the ingredients & maintaining pH. • Set the media & agar for Autoclaving 3. Agrose gel preparation (letting the gel solidify) (20min) 4. Pipetting exercise (40min) 5. Gel loading exercise (10min) 6. Thumb prints on LB agar plates (Concept of Contamination). (10min)		
Week 3: (Microscopy)	Simple Microscopy & Slide Preparation; • Onion root tips & anthers (mitosis & meiosis) (120min) • Preparation of slides (yeast, pond water, bacteria, etc) (60min) • Students will be divided within each group so that half of the group will prepare slides by yeast, pond water, bacteria, etc while other half will prepare the mitosis/meiosis slides.	Manuals	CLO4, CLO7
Week 4: **Molecular biology and genetic engineering-I**	1. PCR for cloning (gene/plasmid) (45min) •Students will be given the amplified product after setting up PCR. 2. Agrose Gel Electrophoresis of PCR product (30min) 3. Ligation (30min) • During incubation students will prepare theie bench for the transformation & spreading. 4. Transformation of bacterial cells (60min) • During the incubation, instructors will discuss more about the gel (in details). • Will inform them about the blue white screening that they will be doing with the transformed cells. 5. Spreading of transformed bacteria & incubating the plates at 37ºC over night. (15min)	Manuals	CLO2, CLO7
Week 5: Molecular biology and genetic engineering-II	1. Plasmid Isolation (mini Prep) from the day 4's inoculums. (1.30hr) • TAs will inoculate the white colonies for students for mini prep. 2. Restriction digest for confirmation of cloned gene (60min) • During incubation, will give students a problem set related to restriction. 3. Agrose gel electrophoresis for isolated plasmid DNA (uncut) & restricted DNA. (60min) • During the time while gel runs, discuss in details about the whole process by cross questioning & problem solving.	Manuals	**CLO2, CLO3, CLO7**
Week 6: Forensic DNA analysis (solving a murder mystery)	How molecular biology helps solve forensic mystries. • A case will be presented to students and they have to do the following 2 steps to identify the murderer. 1. DNA extraction from cheek cells (60min) 2. PCR (60min) 3. Agrose gel electrophoresis from day 9's PCR product. (60min) a. During gel running, will discuss the whole 6 day lab to give them the final words about what they have done & how will it benefit them? b. Will tell them about the lab test (what & when). 4. Gel results and discussion (documentation).	Manuals	**CLO6, CLO7**

Week 7:	Assignment		
	Final Exam		

Textbook(s)/Supplementary Readings
Reading material and lab manual will be available on LMS. Introduction to each module and experimental protocol will be provided in the beginning of each module./ Videos of experiments will also be uploaded on LMS.