



Lahore University of Management Sciences
BIO100 – Experimental Biology lab
Spring 2016

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Course URL (if any)	

Course Basics				
Credit Hours	1			
Lecture(s)	Nbr of Lec(s) Per Week	-	Duration	-
Recitation (per week)	Nbr of Rec (s) Per Week	-	Duration	-
Lab (if any) per week	Nbr of Session(s) Per Week	1	Duration	4 hrs
Tutorial (per week)	Nbr of Tut(s) Per Week	-	Duration	-

Course Distribution	
Core	SSE Core
Elective	NA
Open for Student Category	SSE Freshmen and Others
Closed for Student Category	Non SSE students

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 (<i>in silico</i> 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)
<ul style="list-style-type: none">• None

COURSE OBJECTIVES
<ul style="list-style-type: none">• 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 (<i>in silico</i> 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.



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Course Learning Outcomes	
	<p>At the end of the lab students must have clear understanding of following concepts, tools and their use in the lab:</p> <p>CLO1: Ethical behavior and responsibilities of a scientist in particular working in a bio lab</p> <p>CLO2: How to amplify a gene and clone in a vector, transformation and selection of transformants.</p> <p>CLO3: How to isolate plasmid DNA and analyze using RFLP.</p> <p>CLO4: Simple and fluorescent microscopes: How proteins can be visualized using fluorescent microscopes</p> <p>CLO5: Bioinformatics: <i>in silico</i> analysis of genomes and their application in medicine</p> <p>CLO6: How molecular biology is being used in forensic studies</p> <p>CLO7: Need to maintain lab notebook, detailed data recording, analysis and interpretation.</p>
Grading Breakup and Policy	
<p>Evaluation:</p> <ul style="list-style-type: none"> Every student must maintain a proper hard-bind lab note book, which includes all the experiments performed by him/her in the lab. Students must prepare a lab report for each experiment they conduct in a week. These note books are to be marked by student's respective instructor weekly. Lab notebook, attendance and a test altogether accounts for passing this introductory lab course. <p>Assignment(s): 20% Home Work/Lab Notebook: 30% Quiz(s): Lab performance: 20% Attendance: Midterm Examination: Project: Final Examination: 30%</p>	

Examination Detail	
Midterm Exam	Yes/No: No Combine Separate: Duration: Preferred Date: Exam Specifications:
Final Exam	Yes/No: Yes Combine Separate: Combine Duration: 1 hour Exam Specifications: Will conduct by us, RO does not need to schedule

COURSE OVERVIEW			
Week/ Lecture/ Module	Topics	Recommended Readings	Objectives/ Application
Week1: Introduction to the lab	1. Introduction to biology lab & its objectives (Course contents, good lab practices, writing lab report & maintaining notebooks. why are we doing this Lab?) (40min)		CLO1, CLO7



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	<ol style="list-style-type: none"> Media prep (LB media & agar) (30min) <ul style="list-style-type: none"> Students will prepare media by mixing the ingredients & maintaining pH. Set the media & agar for Autoclaving Agrose gel preparation (letting the gel solidify) (20min) Pipetting exercise (40min) Gel loading exercise (10min) Thumb prints on LB agar plates (Concept of contamination). (10min) 		
Week2: Molecular biology and genetic engineering-I	<ol style="list-style-type: none"> PCR for cloning (gene/plasmid) (45min) <ul style="list-style-type: none"> Students will be given the amplified product after setting up PCR. Agrose Gel Electrophoresis of PCR product (30min) Ligation (30min) <ul style="list-style-type: none"> During incubation students will prepare their bench for the transformation & spreading. Transformation of bacterial cells (60min) <ul style="list-style-type: none"> 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. Spreading of transformed bacteria & incubating the plates at 37°C over night. (15min) 		CLO2, CLO7
Week3: Molecular biology and genetic engineering-II	<ol style="list-style-type: none"> Plasmid Isolation (mini Prep) from the day 4's inoculums. (1.30hr) <ul style="list-style-type: none"> TAs will inoculate the white colonies for students for mini prep. Restriction digest for confirmation of cloned gene (60min) <ul style="list-style-type: none"> During incubation, will give students a problem set related to restriction. Agrose gel electrophoresis for isolated plasmid DNA (uncut) & restricted DNA. (60min) <ul style="list-style-type: none"> During the time while gel runs, discuss in details about the whole process by cross questioning & problem solving. 		CLO2, CLO3, CLO7
Week4: Expression of protein in bacteria	<ol style="list-style-type: none"> Expression of cloned gene in bacteria Prepare SDS gel, use already prepared gels to run sample Samples will include IPTG induced and uninduced samples. Coomassie stain and destain gel Transfection of EGFP tagged Gene in a 		CLO3, CLO4, CLO7



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	mammalian cell line. (90min)		
Week5: Imaging (simple and fluorescent microscopes)	<ol style="list-style-type: none"> 1. Fluorescent Microscopy & Visualization of Transfected cells. (60min) 2. Simple Microscopy & Slide Preparation; <ul style="list-style-type: none"> • 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. 		CLO4, CLO7
Week6: Forensic DNA analysis (solving a murder mystery)	<ul style="list-style-type: none"> • How molecular biology helps solve forensic mysteries. • A case will be presented to students and they have to do the following 2 steps to identify the murderer. <ol style="list-style-type: none"> 1. DNA extraction from cheek cells (60min) 2. PCR (60min) 3. Agrose gel electrophoresis from day 9's PCR product. (60min) <ol style="list-style-type: none"> 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). 		CLO6, CLO7
Week7: Bioinformatics	<p>Bioinformatics (BLAST & Concept of homology modelling)</p> <p>Computer lab above Library.</p>		CLO5, CLO7

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.