

**Institute of Zoology,
Faculty of Life Sciences
University of the Punjab, Lahore
Course Outline**



Programme	BS Zoology	Course Code	ZOOL-414	Credit Hours	2
Course Title	Lab. Bioinformatics				
Course Introduction					
The course will provide:					
<ol style="list-style-type: none"> 1. An Introduction to Bioinformatics. 2. To develop awareness about Fundamental Bioinformatics Databases. 3. Information on the tools used to compute solutions to those problems, and the theory upon which those tools are based. 					
Learning Outcomes					
Upon successful completion of the course, the students should be able to:					
<ol style="list-style-type: none"> 1. GAIN an understanding of the basic concepts of Bioinformatics. 2. EXPLAIN the basics of bioinformatics and computational biology. 3. USE bioinformatics search tools on the internet for mining data, pairwise and multiple sequence alignments and predict protein structures. 					
Course Content			Assignments/Readings		
Week 1	Lab 1: <ul style="list-style-type: none"> • Citation Managers; Setting up Mendeley account (online). Installation of Web importer and in-text Citation Plug-ins to computers/Laptops. 		Hands on Practice of Citation in assignments.		
Week 2	Lab 2: <ul style="list-style-type: none"> • Introduction to NCBI • Retrieving Literature from NCBI • Classification of an organism using NCBI 		Learn about searching relevant literature using effective keywords and filters.		
Week 3	Lab 3: <ul style="list-style-type: none"> • Exploring, different sections of • Protein sequence databases (Uniport), • Protein structure databases (PDB) 				
Week 4	Lab 4: <ul style="list-style-type: none"> • Retrieving FASTA sequence for Nucleotide 		Retrieve FASTA Sequence of 20 different genes from different species. Show your workflow by capturing the screenshots of the steps involved in sequence retrieval.		
Week 5	Lab 5: <ul style="list-style-type: none"> • Retrieving FASTA sequence for Protein 		Retrieve FASTA Sequence of 20 different Proteins from different species. Show your workflow by capturing the screenshots of the steps involved in sequence retrieval.		
Week 6	Lab 6: <ul style="list-style-type: none"> • Retrieving Disease gene information 				
Week 7	Lab 7: <ul style="list-style-type: none"> • Searching gene families 				

Week 8	Lab 8: <ul style="list-style-type: none"> Primer Designing <u>NCBI Primer Designing Tool</u> 	Using sequences from Lab 4, design primers using this tool.
Week 9	Lab 9: <ul style="list-style-type: none"> <u>Primer 3 Plus</u> 	Using sequences from Lab 4, design primers using this tool.
Week 10	Lab 10: <ul style="list-style-type: none"> <u>BLASTing a nucleotide sequence</u> 	Extract primers from published articles, and BLAST the sequences to find out the name of the gene.
Week 11	Lab 11: <ul style="list-style-type: none"> <u>BLASTing an amino acid sequence</u> 	
Week 12	Lab 12: <ul style="list-style-type: none"> <u>Multiple Sequence Alignment using different nucleotide sequences</u> 	
Week 13	Lab 13: <ul style="list-style-type: none"> <u>Multiple Sequence Alignment using different amino acids sequences</u> 	
Week 14	Lab 14: <ul style="list-style-type: none"> Phylogenetic Analysis of different nucleotide sequences 	
Week 15	Lab 15: <ul style="list-style-type: none"> Phylogenetic Analysis of different amino acid sequences 	
Week 16	Lab 16: <ul style="list-style-type: none"> Microarrays data retrieval from the web/ R or Python for Data Analysis 	

Textbooks and Reading Material

Textbooks.

- Lesk A., 2019. Introduction to Bioinformatics. 5th edition Oxford University Press, ISBN-10: 0198794142; ISBN-13 : 978-0198794141

Suggested Readings

- Jiang R., Zhang X. & Zhang, M. (2013). Basics of Bioinformatics: Lecture Notes of the Graduate Summer School on Bioinformatics of China. <https://link.springer.com/book/10.1007/978-3-642-38951-1>
- Primerose, S.B. (2004) Genomics: Applications in Human Biology. Edition 1st. Willey-Blackwell.
- Brown T.A. 2023. Genome 5. Edition 5th, Boca Raton, FL, USA. ISBN 9781003133162 <https://doi.org/10.1201/9781003133162>,
- Kabacoff, R. I. (2015). R in Action (2nd ed.). Manning Publications. <https://www.manning.com/books/r-in-action>

Online resources:

- <https://www.mendeley.com/search/>
- <https://www.ncbi.nlm.nih.gov>
- <https://www.uniprot.org>
- <https://www.rcsb.org>
- <https://www.ncbi.nlm.nih.gov/tools/primer-blast/>
- <https://www.primer3plus.com/index.html>
- <https://blast.ncbi.nlm.nih.gov/Blast.cgi>
- <https://www.ebi.ac.uk/jdispatcher/msa/clustalo>

Teaching Learning Strategies

- Use of Technology resources.

2. Use of Google Classroom management and Tools Resources
3. Provision of Handouts
4. Demonstration of the concepts using animations of cellular processes
5. Group activity of the students for problem solving skills

Assignments: Types and Number with Calendar

1. Assignment 1 (Theory): Due by 15th week of semester.

Instructions:

- i. Every student will/be select/allocated one gene.
- ii. The gene for analysis cannot be repeated in the same batch.
- iii. The gene sequence of 20 different species will be extracted to perform MSA and construct the phylogenetic tree.
- iv. The components of the tree will be explained and the most closely and most distantly related species will be figured out.

2. Lab Manual/Notebook: Due before Final Term Examination

Instructions:

- i. The students will prepare the lab manuals (word document or google doc).
- ii. The working of each method will be shown in the manual as screen shot (Complete screen; no cropped screen screenshots allowed).
- iii. All other information will be included (written form or if gene sequences, then copy paste) as text in the document.
- iv. At the end of the semester the lab manual will be printed for presentation at final term lab examination.

Assessment

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes, Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.