MAHATMA GANDHI UNIVERSITY

Kottayam, Kerala

Undergraduate Programmes (HONOURS)
2024 Admission Onwards

SYLLABUS						
SIGNATURE COURSE						
Name of the College	UC College, Aluva					
Faculty/ Discipline	Zoology					
Programme	BSc (Hons) Zoology					
Course Coordinator	Rima Joseph					
Contributors						
Course Name	INTRODUCTION TO COMPUTATIONAL BIOLOGY & BIOSTATISTICAL METHODS					
Type of Course	DSE					
Specialization title	This Signature Course does not have a specialization.					
Course Code	MG5DSEZGYA01					
Course Level	300					
Course Summary	This course introduces students to the fundamentals of computational biology, focusing on biological data types, sequence similarity, and the use of major databases such as NCBI, UniProt, and PDB. It emphasizes the interpretation and application of sequence comparison tools like BLAST and Clustal Omega, and introduces concepts in structural biology, protein visualization, and basic pharmacology. In parallel, students are trained in the basics of biostatistics including data types, descriptive statistics and graphical representations using tools like GraphPad Prism and JASP. The course fosters practical understanding through tool-based exploration and prepares students for computational approaches in biological analysis.					
Semester	5	**Credits**			4	**Total Hours**
Course Details	**Learning Approach**	Lecture	Tutorial	Practical	Others	
		3		1		75
Pre-requisites, if any	Basic knowledge of molecular biology, genetics, and introductory statistics at the higher secondary or first-year undergraduate level is recommended. Familiarity with computer usage and internet-based research tools will be helpful but not mandatory.					

Course Outcomes (CO)

Number of COs		**4**	
CO No.	**Expected Course Outcome**	**Learning Domains ***	**PO No**
1	Identify types of biological data and explain the use of key biological databases.	U	PO1, PO2
2	Interpret protein structures and relate them to basic pharmacological concepts and omics understanding.	U	PO2, PO3
3	Apply descriptive statistical methods to summarize and visualize biological data using software tools.	A	PO1, PO2, PO10
4	Demonstrate biological database navigation and perform statistical analysis using computational tools.	A, S	PO1, PO2, PO10

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

CO-PO Articulation Matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	2	2	-	-	-	-	-	-	-	-
CO 2	-	2	2	-	-	-	-	-	-	-
CO 3	2	2	-	-	-	-	-	-	-	2
CO 4	3	3	-	-	-	-	-	-	-	2

'0' is No Correlation, '1' is Slight Correlation (Low level), '2' is Moderate Correlation (Medium level) and '3' is Substantial Correlation (High level).

Course Content

Content for Classroom transaction (Units)

Module	Units	Course Description	Hrs	CO No.
1	Introduction to Computational Biology			
	1.1	What is computational biology? Applications in medicine and drug discovery	4	["1"]
	1.2	Types of biological data (DNA, RNA, proteins)	3	["1"]
	1.3	Introduction to biological databases: NCBI, UniProt, PDB	4	["1"]
	1.4	Sequence similarity: what and why?	4	["1"]
2	Structural Biology, Pharmacology & Omics			
	2.1	Protein structure levels	3	["2"]
	2.2	Protein-ligand interaction (Basic Concept)	3	["2"]
	2.3	Use of PDB to visualize protein structures	3	["2"]
	2.4	Introduction to pharmacology and drug action	3	["2"]
	2.5	Brief introduction to omics: genomics, transcriptomics, proteomics and their role in disease understanding and drug design	3	["2"]
3	Basics of Biostatistics			
	3.1	Types of data: qualitative and quantitative	3	["3"]
	3.2	Measures of central tendency: mean, median, mode	3	["3"]
	3.3	Measures of dispersion: range, variance, standard deviation	3	["3"]
	3.4	Additional measures of data description: standard error of mean (SEM), coefficient of variation (CV), skewness, kurtosis	3	["3"]
	3.5	Graphical representation: bar chart, pie chart, box plot	3	["3"]

Module	Units	Course Description	Hrs	CO No.
4	Practical – Basic Tools			
	4.1	Descriptive statistics for characterizing biological data (mean, median, SD, range, normality checks) using GraphPad Prism/JASP	10	["4"]
	4.2	Graphical visualization in GraphPad Prism/JASP: box plots, bar charts, Q-Q Plot, Scatter Plot	10	["4"]
	4.3	Accessing and navigating biological databases: NCBI, UniProt, PDB	5	["4"]
	4.4	Using BLAST and Clustal Omega for sequence comparison	5	["4"]

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Classroom instruction will be delivered using a combination of lectures, demonstrations, active learning, and problem-based discussions. Practical sessions will emphasize experiential learning through mini-projects, simulations, and self-paced exploration of in silico tools.

Assessment Types	**MODE OF ASSESSMENT** Mode of Assessment: Both **A. Continuous Comprehensive Assessment (CCA)** **• Theory – 25 Marks** Assignment – 10 marks, Quiz / Class Test – 10 marks, Tool-based Micro-Presentation – 5 marks **• Practical – 15 Marks** Mini Project and Report – 5 marks, Viva Voce – 5 marks, Lab Involvement – 5 marks **B. End Semester Evaluation (ESE)** **• Theory – 50 Marks** Assessment Methods – MCQ, Short answer, Short Essays Duration of Examination – 1.50 Hrs Pattern of examination for Theory – Non-MCQ Different parts of written examination – Part - A , B , C Answer Type: ◦ PART - A ◦ MCQ - (10 out of 10) – 10 × 1 = 10 ◦ PART - B ◦ Short answer - (10 out of 15) – 10 × 2 = 20 ◦ PART - C ◦ Short Essays/Problems - (5 out of 10) – 5 × 4 = 20 **• Practical – 35 Marks** Assessment Methods – Mini Project Report, Viva, Spotters, Demonstration Duration of Examination – 2.00 Hrs

References

- Griffiths, A. J. F., Wessler, S. R., Carroll, S. B., & Doebley, J. (2012). Introduction to genetic analysis (10th ed.). W. H. Freeman and Company.
- Rastogi, S. C., Mendiratta, N., & Rastogi, P. (2004). Bioinformatics: Methods and applications: Genomics, proteomics and drug discovery. Prentice-Hall of India Private Limited.
- Xiong, J. (2006). Essential bioinformatics (South Asian ed.). Cambridge University Press.
- Rastogi, V. B. (2008). Fundamentals of biostatistics (2nd ed.). Ane Books Pvt. Ltd.
- Le, C. T., & Eberly, L. E. (2016). Introductory biostatistics (2nd ed.). John Wiley & Sons.

Suggested Readings

- Lesk, A. M. (2020). Introduction to bioinformatics (2nd international ed.). Oxford University Press.
- Motulsky, H. (2018). Intuitive biostatistics: A nonmathematical guide to statistical thinking (4th ed.). Oxford University Press.
- Lesk, A. M. (2012). Introduction to genomics (2nd ed., South Asia ed.). Oxford University Press.
- GraphPad Prism and JASP user manuals

Affidavit

- We, UC College, Aluva and Rima Joseph, retain the copyright of this syllabus and expressly prohibit its distribution in complete form to any institution outside our own.
- We, UC College, Aluva, agree to appoint a new course coordinator for the proposed INTRODUCTION TO COMPUTATIONAL BIOLOGY & BIOSTATISTICAL METHODS in the event of the unavailability of the currently nominated coordinator. This appointment will ensure the continued coordination of course delivery, assessments, and all related academic responsibilities necessary for the successful implementation of the signature course, for as long as the college offers this programme.
- We, UC College, Aluva and Rima Joseph, declare that no part of this signature course submitted here for approval has been taken from the course content developed by, or from any of the course titles prepared by, the BoS/expert committee in the same discipline under our University.