Shirpur Education Society's

R. C. Patel Institute of Technology, Shirpur

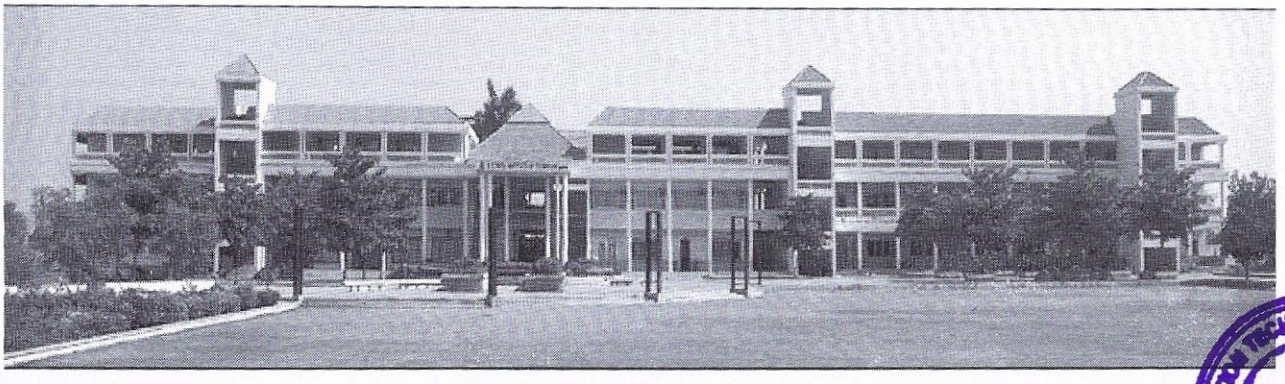
(An Autonomous Institute)

Course Structure and Syllabus

Honors Degree Program in Computational Biology

Artificial Intelligence (AI) and Data Science

With effect from Year 2025-26



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Honors Degree Program in Computational Biology (w.e.f. 2025-26)

Sr	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total	Credit	
							Continuous Assessment (CA)							
							TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Average of (TT1 & TT2)	ESE			
				L	T	P	[A]			[B]	[C]	[A+B+C]		
Sem-III														
1	H1	RCP24SH1301	Computational Cellular Biology	3			25	15	15	15	60	100	3	3
Sem-IV														
2	H1	RCP24SH1401	Computational Molecular Biology	3			25	15	15	15	60	100	3	3
Sem-V														
3	H1	RCP24SH1501	Algorithms for Computational Biology	3			25	15	15	15	60	100	3	4
	H1	RCP24SH1501L	Algorithms for Computational Biology Laboratory			2	25				25	50	1	
Sem-VI														
4	H1	RCP24SH1601	Computational Models for Biology	3			25	15	15	15	60	100	3	4
	H1	RCP24SH1601L	Computational Models for Biology Laboratory			2	25				25	50	1	
Sem-VIII														
5	H1	RCP24SH1801	Bigdata in Bioinformatics	4			25	15	15	15	60	100	4	4
			Total	16		4	175			75	350	600	18	

Prepared by: Prof. V. V. Katre

Prof. Dr. D. R. Patil
BOS Chairman

Prof. Dr. P. J. Deore
Dean Academics/Dy. Director

Checked by: Prof. T. A. Tayde

Prof. S. P. Shukla
C.O.E.

Prof. Dr. J. B. Patil
Director

INFORMATION TECHNOLOGY DEPT. R.C.P.I.T. SHIRPUR Office Seal

Semester - III

Program: Honors Degree Program in Computational Biology Artificial Intelligence and Data Science	S. Y. B.Tech	Semester: III
Computational Cellular Biology (RCP24SH1301)		

Course Objective(s):

1. Analyze cell structure the concepts of cellular transportation systems and cell signaling Familiarisation to Molecular Biology.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Define and recall the cell structure and functions.	L1	Remember
CO2	Classify the cell constituents and biomolecules.	L4	Analyse
CO3	Elaborate the principles and regulations of replication, transcription and translation mechanism.	L2	Understand
CO4	Develop knowledge on genome-level cellular organization.	L6	Create
CO5	Identify the cellular data and apply basic sequencing algorithms.	L1	Remember

Computational Cellular Biology (RCP24SH1301) Course Contents

Unit-I

07 Hrs.

Cell Types, their Structure and Function, Cell-:

Unit of life, Cell morphology, Difference between bacterial, Plant and Animal cells, Structure and function of membranes, Membrane organization and composition, Structure and functions of cell organelles - Nucleus, Mitochondria, Ribosome, Golgi bodies, Lysosomes, Endoplasmic reticulum, Peroxisomes, Chloroplast and vacuoles.

Unit-II

07 Hrs.

Cellular Transport Systems Transport types-:

Passive and Active transport, Permeases, Na+/K+, Ca2+ - ATPase pumps, ATP dependent proton pumps Cotransport, Symport, Antiport, Role of lysosomal and vacuolar membrane in cellular transport, Transport into prokaryotic cells, Endocytosis and Exocytosis, Entry of viruses and toxins into the cells.

Unit-III

06 Hrs.

Cell Signaling Types -: Autocrine, Paracrine, and Endocrine signaling molecules, Secondary signaling molecules G-protein coupled signal transduction pathways involving cAMP, cGMP, IP3, DAG and Ca2+ as second messengers.

Unit-IV

07 Hrs.

Genome Organization Structure of DNA-: Nucleotides, Nucleosides, Sugar, Bases, Bonds involved in double stranded DNA; Chargaff's rule; Genome organization in prokaryotes and eukaryotes; Chromosome structure – Different types of histones and chromosome packing; Central dogma of life; DNA and RNA as genetic material; Differences between DNA and RNA

Unit-V

06 Hrs.

Types of Data in Cellular Biology-:

Genomic Data, Proteomic Data, Metabolomic Data, Imaging Data, Signal Transduction Data, Data Analysis Techniques: Hypothesis testing, Regression Analysis, Survival Analysis (Kaplan-Meier curves and Cox), False Discovery Rates

Unit-VI

06 Hrs.

Sequence Alignment Algorithms-: Needleman-Wunsch Algorithm: Used for global sequence alignment, such as aligning DNA or protein sequences to identify similarities and differences. Smith-Waterman Algorithm: Used for local sequence alignment, useful for identifying regions of similarity between sequences. Sequencing Applications

Text Books:

1. Lodish H, Berk A Kaiser CA Krieger M, Bretscher A, Ploegh H, Amon A, Martin KC (2012) Molecular Cell Biology, 7^{th} edition, W.H. Freeman. USA.

Reference Books:

1. Cooper GM and Hausman RE (2013) The Cell: A Molecular Approach. 6^{th} edition. Sinauer Associates, Inc. USA
2. Alberts B, Johnson A, Lewis J, Morgan D, Raff M, Roberts K, and Walter P (2014) Molecular
3. Biology of the Cell. 6^{th}edition. Garland Science, USA.