



SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

M.Sc. Bioinformatics Semester-I

Course Type	Course Code	Course Title	Teaching-Learning Scheme	Total Notional Hours	Course credits
			L-P-T		
DSC	P2T01NCBIF01	Molecular Biology	4-0-1	120	04

• Course Learning Outcomes (CLOs)

On completion of this course, students will be able to:

CLO1: Understand structure and replication mechanisms of DNA in prokaryotes and eukaryotes.

CLO2: Explain transcription, RNA processing, and different types of RNA.

CLO3: Analyze gene expression and translation mechanisms including genetic code.

CLO4: Apply concepts of recombinant DNA technology and cloning strategies.

CLO5: Interpret PCR techniques and their applications in molecular biology.

CLO6: Evaluate modern molecular biology tools and experimental approaches.

Unit	Course Content	Learning Pedagogies*	CLO(s)
I	<u>DNA structure</u> DNA structure: Chemistry of DNA, DNA structure, Different conformations of DNA (B, A and Z), Denaturation and Renaturation (Cot curves) of DNA. DNA topology: Supercoiling, Biology of Supercoiled DNA, DNA topoisomerases and their mechanism of action. DNA- protein interactions: General features, Sequence specific DNA binding protein motifs, ss DNA binding proteins.	Lecture-based learning, ICT-enabled learning, Self-directed learning	CLO1
II	<u>Organization of genome and its replication</u> : Packaging of DNA and organization of chromosome in bacterial cells; Packaging of DNA in eukaryotic nucleosome and chromatin condensation, assembly of nucleosomes upon replication, chromatin modification. DNA replication: Mechanism of DNA polymerase catalyzed synthesis of DNA, Types of DNA polymerases in bacteria, Initiation of DNA replication and its regulation in prokaryotes, assembly of replisome and progress of replication fork, termination of replication. DNA replication in eukaryotes and archaea. Inhibitors of DNA replication.	Lecture method, ICT-enabled learning	CLO2
III	<u>Gene expression in prokaryotes and eukaryotes</u> <u>Transcription</u> : RNA polymerases, features of prokaryotic and eukaryotic promoters, assembly of transcription initiation complex in prokaryotes and eukaryotes, and its regulation; synthesis and processing of prokaryotic and eukaryotic transcripts. Translation: structure and role of t-RNA in protein	Seminar, ICT-enabled learning	CLO3



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	synthesis, ribosome structure, basic features of genetic code and its deciphering, translation (initiation, elongation and termination in detail in prokaryotes as well as eukaryotes).		
IV	<u>Regulation of gene expression:</u> Regulation of gene expression in prokaryotes: Operon concept, positive and negative regulation. Examples of <i>lac</i> (including mutational analysis), <i>ara</i> , and <i>trp</i> operon regulation; global regulatory responses. Regulation of gene expression in eukaryotes: Transcriptional, translational and processing level control mechanisms.	ICT-enabled learning,	CLO4, CLO5, CLO6

- **(*) Learning Pedagogies/Methods**

Notes:

(1) The following list is suggestive. Any other learning pedagogies relevant to discipline-specific requirements can be added.

(2) Acronyms/abbreviations of the terms can be placed in the above table.

- (a) Interactive Classroom Lecture
- (b) Classroom Lecture (CL)
- (c) Seminars (Student-led and Faculty-moderated)
- (d) Micro-Projects/Mini Research Tasks
- (e) Industrial Visit/Field Visit/Institutional Visit
- (f) Problem-Based Learning (PBL)
- (g) Research-Oriented Learning (Literature Review, Tool Construction, Data Analysis Exercises)
- (h) Collaborative Learning (Group Tasks, Peer Discussion, Joint Presentations)
- (i) Experiential Learning (Community Engagement, Internship-linked Activities, Practice-based Tasks)
- (j) ICT-Enabled Learning (LMS-based Tasks, Digital Resources, Virtual Labs/Webinars)
- (k) Reflective Practices (Learning Journals, Reflective Notes, Concept Mapping)
- (l) Self-Directed Learning (Guided Readings, Concept Exploration Tasks)

- **Assessment Methodologies**

Internal Assessment

a. Internal Formative assessment (30)

- (a) Quiz
- (b) Assignment
- (c) Seminar/Presentation
- (d) Group Task
- (e) Attendance

b. Internal Summative Assessment (20)

- (a) Mid -Term

(A) External Assessment (50)

- (a) End-Term



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(B) Weightage of Learning Efforts for External Assessment

Unit	Aligned COs	Total Learning Hours	Approximate weightage (Marks) to Learning levels (BT)			Total Marks
			Remember (R)	Understanding (U)	Application/Analyse & above (A)	
I	CLO1	30	1	1	12	14
II	CLO2	32	1	1	10	12
III	CLO3	28	1	1	10	12
IV	CLO4, CLO5, CLO6	30	1	1	12	14
		120	04	04	34	50

• Assessment and Evaluation

Sr. No.	Assessment/Evaluation	Component	Weightage (%)
1	Continuous Internal Evaluation	Seminars, Assignments, Quizzes, Class Regularity,	50%
2	End-Semester Examination	Written Exam/Practical Exam Project Evaluation (Report, Presentation, Viva)	50%

• CLOs – PLOs Matrix

CLO	PLO									
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	3	2	-	-	-	-	-	-	2	-
CLO2	2	3	2	-	-	-	-	-	3	-
CLO3	-	2	3	2	-	-	-	-	2	1
CLO4	-	-	2	3	2	-	-	-	3	2
CLO5	-	-	-	2	3	2	-	-	2	3
CLO6	-	-	-	-	2	3	2	2	-	2

Values to CLO-PLO matrix are assigned by judging the importance of the particular CLO in relation to the PLOs.

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-



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- Suggested Learning Materials Books:**

Sr. No.	Title	Author(s)	Edition/Year	Publisher
1	Genome	T. A. Brown	4th Edition / 2018	Garland Science
2	Molecular Biotechnology	Bernard R. Glick, Jack J. Pasternak, Cheryl L. Patten	5th Edition / 2010	ASM Press
3	Principles of Gene Manipulation and Genomics	Sandy B. Primrose, Richard Twyman	7th Edition / 2006	Blackwell Publishing
4.	Molecular Cloning: A Laboratory Manual	Michael R. Green, Joseph Sambrook	4th Edition / 2012	Cold Spring Harbor Laboratory Press

- Online Resources (Open Source)**

Sr. No.	Description of Resource(s)	Weblink
1	NCBI Database (Genomic & Molecular Data)	https://www.ncbi.nlm.nih.gov
2	European Bioinformatics Institute (EBI) Resources	https://www.ebi.ac.uk
3	Molecular Biology Tutorials (Khan Academy)	https://www.khanacademy.org/science/ap-biology
4	Research Articles and Reviews (Nature)	https://www.nature.com



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M.Sc. Bioinformatics Semester-I

Course Type	Course Code	Course Title	Teaching-Learning Scheme	Total Notional Hours	Course credits
			L-P-T		
DSC	P2T01NCBIF02	Biocomputing Fundamentals	4-0-1	120	04

• Course Learning Outcomes (CLOs)

On completion of this course, students will be able to:

CLO1: Understand the fundamentals of Java programming, object-oriented concepts, data types, variables, arrays, operators, and control statements.

CLO2: Develop Java programs using classes, objects, methods, constructors, recursion, access control, static members, and string handling.

CLO3: Apply inheritance concepts including multilevel inheritance, method overriding, dynamic method dispatch, abstract classes, and final keyword usage.

CLO4: Create modular Java applications using packages, interfaces, exception handling mechanisms, and user-defined exceptions.

CLO5: Implement file handling and input/output operations using byte streams, character streams, console input, and file writing techniques.

CLO6: Explain Indian logic (Navya-Nyaya) and apply its principles of structured reasoning to basic computational thinking and programming techniques using case studies.:

Unit	Course Content	Learning Pedagogies*	CLO(s)
I	Indian Logic and Computation: Programming techniques for experience taking examples from the texts of Navya Nyay, Various Case Studies related to Navya Nyay. <u>The Genesis of Java:</u> An overview of JAVA, Object Oriented Programming, Data types Variables and Arrays, the simple types, Floating point types. Operators, Control statements. Introducing classes: Class fundamentals, Declaring objects, Assigning object reference variables, Introducing methods, Constructors, this keyword. Garbage collection, using objects as parameters, Argument passing, Retaining objects, Recursion, Introducing Access control, Understanding static. Nested and inner classes, exploring the string class, Using command line arguments.	Lecture-based learning, ICT-enabled learning, Self-directed learning	CLO1, CLO2
II	<u>Inheritance:</u> Basics, Member access and inheritance. Using super: to call super class constructors, Creating a multilevel hierarchy, Method overriding, Dynamic method dispatch, Using abstract classes, Using final with inheritance, Using final to prevent overriding, Using final to prevent inheritance, The object class.	Lecture method, Problem-based learning	CLO3



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III	<u>Packages and Interfaces:</u> Packages, defining a package, understanding class path, Access protection: Importing packages, Defining an interface. Implementing interfaces, Applying interfaces, Variables in interfaces. Exception handling: Fundamentals, Exception types, Uncaught exceptions, Using try and catch, Displaying a description of an exception. Multiple catch clauses. Nested statements, throw, throws. Java's built in exceptions, Creating own exception subclasses, Using exceptions.	Seminar, ICT-enabled learning, Collaborative learning	CLO4
IV	<u>I/O Applets:</u> I/O basics - Streams, Byte streams and character streams. The predefined streams; Reading console Input: reading characters, reading strings, Writing files, Applets, Fundamentals, The transient and volatile modifiers, Using instance of Native methods, Problems with native methods.	Experiential learning, Problem-based learning, ICT-enabled learning, Micro-projects	CLO5, CLO6

- **(*) Learning Pedagogies/Methods**

Notes:

(1) The following list is suggestive. Any other learning pedagogies relevant to discipline-specific requirements can be added.

(2) Acronyms/abbreviations of the terms can be placed in the above table.

- (a) Interactive Classroom Lecture
- (b) Classroom Lecture (CL)
- (c) Seminars (Student-led and Faculty-moderated)
- (d) Micro-Projects/Mini Research Tasks
- (e) Industrial Visit/Field Visit/Institutional Visit
- (f) Problem-Based Learning (PBL)
- (g) Research-Oriented Learning (Literature Review, Tool Construction, Data Analysis Exercises)
- (h) Collaborative Learning (Group Tasks, Peer Discussion, Joint Presentations)
- (i) Experiential Learning (Community Engagement, Internship-linked Activities, Practice-based Tasks)
- (j) ICT-Enabled Learning (LMS-based Tasks, Digital Resources, Virtual Labs/Webinars)
- (k) Reflective Practices (Learning Journals, Reflective Notes, Concept Mapping)
- (l) Self-Directed Learning (Guided Readings, Concept Exploration Tasks)

- **Assessment Methodologies**

(A) Internal Assessment

a. Internal Formative assessment (30)

- (a) Quiz
- (b) Assignment
- (c) Seminar/Presentation
- (d) Group Task
- (e) Attendance

b. Internal Summative Assessment (20)

- (a) Mid -Term



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(B) External Assessment (50)

(a) End-Term

(B) Weightage of Learning Efforts for External Assessment

Unit	Aligned COs	Total Learning Hours	Approximate weightage (Marks) to Learning levels (BT)			Total Marks
			Remember (R)	Understanding (U)	Application/ Analyse & above (A)	
I	CLO1, CLO2	30	1	1	12	14
II	CLO3	32	1	1	10	12
III	CLO4	28	1	1	10	12
IV	CLO5, CLO6	30	1	1	12	14
		120	04	04	34	50

• Assessment and Evaluation

Sr. No.	Assessment/Evaluation	Component	Weightage (%)
1	Continuous Internal Evaluation	Seminars, Assignments, Quizzes, Class Regularity	50%
2	End-Semester Examination	Written Exam/Practical Exam Project Evaluation (Report, Presentation, Viva)	50%

(C) CLOs – PLOs Matrix

CLO	PLO									
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	3	2	-	-	-	-	-	-	2	-
CLO2	2	3	2	-	-	-	-	-	3	-
CLO3	-	2	3	2	-	-	-	-	2	1
CLO4	-	-	2	3	2	-	-	-	3	2
CLO5	-	-	-	2	3	2	-	-	2	3
CLO6	-	-	-	-	2	3	2	2	-	2

Values to CLO-PLO matrix are assigned by judging the importance of the particular CLO in relation to the PLOs.

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-



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- Suggested Learning Materials Books:**

Sr. No.	Title	Author(s)	Edition/Year	Publisher
1	Java: The Complete Reference	Herbert Schildt	11th Edition / 2018	McGraw-Hill Education
2	Object-Oriented Programming with Java	E. Balagurusamy	6th Edition / 2019	McGraw-Hill Education
3	Core Java Volume I – Fundamentals	Cay S. Horstmann	11th Edition / 2018	Pearson

- Online Resources (Open Source)**

Sr. No.	Description of Resource(s)	Weblink
1	Java Programming Tutorials (W3Schools)	https://www.w3schools.com/java
2	Official Java Documentation (Oracle)	https://docs.oracle.com/javase
3	Java Concepts and Coding Examples (GeeksforGeeks)	https://www.geeksforgeeks.org/java
4	Java Learning Platform (Javatpoint)	https://www.javatpoint.com



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M.Sc. Bioinformatics Semester-I

Course Type	Course Code	Course Title	Teaching-Learning Scheme	Total Notional Hours	Course credits
			L-P-T		
DSC	P2T01NCBIF03	IT Fundamentals	4-0-1	120	04

• Course Learning Outcomes (CLOs)

On completion of this course, students will be able to:

CLO1: Explain the fundamental concepts of computer organization, including basic components and operations, and interpret various number systems used in computing.

CLO2: Apply knowledge of CPU architecture, memory hierarchy, and input/output devices to understand how a computer system processes and manages data.

CLO3: Analyze instruction execution cycles, control flow structures, and Boolean logic to understand how programs are executed at the hardware and logical levels.

CLO4: Design simple algorithms and represent problem-solving approaches using flowcharts for basic programming tasks.

CLO5: Describe fundamental data structures such as arrays, stacks, and queues, and demonstrate their use in solving computational problems.

CLO6: Evaluate different problem-solving techniques by analyzing their computational efficiency and suitability for given tasks.

Unit	Course Content	Learning Pedagogies*	CLO(s)
I	<u>Computer Fundamentals:</u> Block Structure of a computer, characteristics of computers, classification of computers. Number System: Bit, byte, binary, decimal, hexadecimal and octal systems, conversion from one system to the other. Character codes (ASCII, EBCDIC, BCD, Excess-3 Grey). Introduction to Programming: Algorithms, Flow Charts, Basic constructs of Programming Languages, Types of programming languages.	Classroom lectures, problem-solving, ICT tools	CLO1, CLO4
II	<u>Processors, Memory and Input / Output:</u> CPU organization, Instruction execution, RISC Vs. CISC Instruction-level parallelism: pipelining, superscalar architectures Processor-level parallelism: array computers, multiprocessors, multicomputers' Microprocessor chips, Architecture of a typical microprocessor. Memory: main memory, secondary memory, types & organization. Input/Output: common types of I/O devices, Controllers	Lectures, group discussion, case-based learning	CLO2
III	<u>Instructions and Flow of Control:</u> Design criteria for instruction formats, Addressing techniques, Instruction types, & Interrupts, Gates and Boolean Algebra Gates, Boolean algebra, Truth tables, Circuit equivalence, De Morgan's theorems	Lectures, problem-based learning, practice exercises	CLO3



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IV	<u>Introduction To Data Structures:</u> Time and space efficiency of algorithms, Primitive and Composite data types, Arrays, Stacks, Queues: Randomization & other Concepts: Linked Lists, Binary Trees, Hashing techniques for direct files. Inverted lists, Multi-lists, Heaps. <u>Ayurvedic Bioinformatics: Pattern Recognition in Diagnosis, Sanskrit & NLP (Machine Translation, Sentiment Analysis), Ethical AI & Indian Philosophy (Dharma, Karma in Algorithmic Bias).</u>	Classroom lectures, problem-solving, ICT tools	CLO4, CLO5, CLO6
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- (*) Learning Pedagogies/Methods

Notes:

1. The following list is suggestive. Any other learning pedagogies relevant to discipline-specific requirements can be added.

2. Acronyms/abbreviations of the terms can be placed in the above table.

- (a) Interactive Classroom Lecture
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- (k) Reflective Practices (Learning Journals, Reflective Notes, Concept Mapping)
- (l) Self-Directed Learning (Guided Readings, Concept Exploration Tasks)

- Assessment Methodologies

(A) Internal Assessment

a. Internal Formative assessment (30)

- (a) Quiz
- (b) Assignment
- (c) Seminar/Presentation
- (d) Group Task
- (e) Attendance

b. Internal Summative Assessment (20)

- (a) Mid –Term

(B) External Assessment (50)

- (a) End-Term



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M.Sc. Bioinformatics Semester-I

(B) Weightage of Learning Efforts for External Assessment

Unit	Aligned COs	Total Learning Hours	Approximate weightage (Marks) to Learning levels (BT)			Total Marks
			Remember (R)	Understanding (U)	Application/ Analyse & above (A)	
I	CLO1, CLO4	30	1	1	12	14
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IV	CLO4, CLO5, CLO6	30	1	1	12	14
		120	04	04	34	50

• Assessment and Evaluation

Sr. No.	Assessment/Evaluation	Component	Weightage (%)
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(B) CLOs – PLOs Matrix

CLO	PLO									
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	3	2	-	-	-	-	-	-	-	-
CLO2	3	3	2	-	-	-	-	-	-	-
CLO3	3	3	3	2	-	-	-	-	-	-
CLO4	3	3	3	2	2	-	-	-	-	-
CLO5	2	3	3	3	2	-	-	-	-	-
CLO6	2	3	3	3	3	2	-	-	-	-

Values to CLO-PLO matrix are assigned by judging the importance of the particular CLO in relation to the PLOs.

CLO – PLO correlation	Value
Strong	3
Moderate	2
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No correlation	-



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M.Sc. Bioinformatics Semester-I

- Suggested Learning Materials Books:**

Sr.No.	Title	Author(s)	Edition/Year	Publisher
1	Computer Fundamentals	P.K. Sinha	6th Edition / 2019	BPB Publications
2	Computer Organization and Architecture	William Stallings	10th Edition / 2021	Pearson
3	Introduction to Algorithms	Thomas H. Cormen	4th Edition / 2022	MIT Press

- Online Resources (Open Source)**

Sr. No.	Description of Resource(s)	Weblink
1	Basics of Computer Fundamentals	https://www.tutorialspoint.com/computer_fundamentals
2	CPU & Architecture Concepts	https://www.geeksforgeeks.org/computer-organization-and-architecture-tutorials/
3	Programming & Algorithms	https://www.w3schools.com
4	AI, NLP & Ethics Basics	https://www.ibm.com/topics/artificial-intelligence



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M.Sc. Bioinformatics Semester-I

Course Type	Course Code	Course Title	Teaching-Learning Scheme	Total Notional Hours	Course credits
			L-P-T		
DSC	P2T01NCBIF04	Practical's based on Molecular Biology and Biocomputing	0-8-0	120	04

• Course Learning Outcomes (CLOs)

On completion of this course, students will be able to:

CLO1: Perform isolation of chromosomal and plasmid DNA from bacteria using standard molecular biology techniques.

CLO2: Apply restriction digestion, agarose gel electrophoresis, and PCR techniques for DNA analysis and amplification.

CLO3: Develop basic Java programs to solve computational problems such as factorial, prime numbers, series, and mathematical calculations.

CLO4: Implement Java programs using arrays, strings, and command-line arguments for data processing and manipulation.

CLO5: Design GUI-based Java applications and applets using components like buttons, text fields, list boxes, layouts, and event handling.

CLO6: Create file handling applications in Java to read, write, and display data using both console and GUI-based approaches.

Practical Content	Learning Pedagogies*	CLO(s)
- Isolation of chromosomal DNA from bacteria - Isolation of plasmid DNA from bacteria by alkaline lysis method - Restriction digestion of plasmid DNA - DNA agarose gel electrophoresis - Polymerase chain reaction - Real Time PCR - Write a Java Program find the Area of circle. - Write a Java Program that will display Factorial of the given number. - Write a Java Program that will display the sum of $1+1/2+1/3+...+1/n$. - Write a Java Program that will display 25 Prime nos. - Write a Java Program that will accept command-line arguments and display the same. - Write a Java Program to sort the elements of an array in ascending order. - Write a Java Program which will read a text and count all occurrences of a particular word. - Write a Java Program which will read a string and rewrite it in the alphabetical order e.g. The word "STRING" should be written a "GINRST".	Demonstration-based, Laboratory Teaching, Hands-on Practical / Experimental Learning, Problem-solving, Coding Practice, GUI-based Learning, Application-based Learning	CLO1 to CLO6



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15. Make an Applet that create two buttons named “Red” and “Blue” when a button is pressed the background color of the applets is set to the color named by the button’s label. 15. Write a Java Applet that create some text fields and text areas to demonstrate features of each.		
16. Use a Grid layout class to arrange a few instances of circle canvas.		
17. Write any Java Program using new operator.		
18. Write a Program to create a List Box and a Text Area. Fill up the List Box with some file names. When user double clicks on any filename of the list box, the file should be opened, and its contents should be displayed in the text Area.		
19. Create an application with a Text Field, a Text Area and button show. User must enter the name of the file in the Text Field. When the button show is pressed, the contents of the file should be displayed in the Text Area.		
20. Create a Text Field, a button and a list box, User must enter a number in the Text Field. When user clicks on the button, the arithmetic table for that number should be displayed in the list box. If the user repeats this process the list box should be cleared and refilled by the latest values.		
21. Develop a program to write the text “Hello, how are you” to a file “Hello.txt”. Also develop a program to read this file and to display the contents of this file using suitable GUI.		

• (*) Learning Pedagogies/Methods

Notes:

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M.Sc. Bioinformatics Semester-I

Assessment Methodologies

(A) Internal Assessment

a. Internal Formative assessment (30)

- (a) Quiz
- (b) Assignment
- (c) Seminar/Presentation
- (d) Group Task
- (e) Attendance

Internal Summative Assessment (20)

- (f) Mid –Term

(B) External Assessment (50)

- (a) End-Term

(B) Weightage of Learning Efforts for External Assessment

Aligned COs	Total Learning Hours	Approximate weightage (Marks) to Learning levels (BT)			Total Marks
		Remember (R)	Understanding (U)	Application/ Analyse & above (A)	
CLO1 to CLO6	120	5	5	35	50
	120	5	5	35	50

(C) CLOs – PLOs Matrix

CLO	PLO									
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	3	2	-	-	-	-	-	-	-	-
CLO2	3	3	2	-	-	-	-	-	-	-
CLO3	2	3	3	2	-	-	-	-	-	-
CLO4	2	3	3	2	-	-	-	-	-	-
CLO5	-	2	3	3	2	-	-	-	-	-
CLO6	-	2	3	3	2	-	-	-	-	-

Values to CLO-PLO matrix are assigned by judging the importance of the particular CLO in relation to the PLOs.

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-



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- Suggested Learning Materials Books:**

Sr. No.	Title	Author(s)	Edition/Year	Publisher
1	Molecular Biology of the Gene	James D. Watson et al.	7th Edition / 2013	Pearson
2	Gene Cloning and DNA Analysis	T.A. Brown	7th Edition / 2016	Wiley-Blackwell
3	Java: The Complete Reference	Herbert Schildt	11th Edition / 2018	McGraw Hill
4.	Head First Java	Kathy Sierra & Bert Bates	2nd Edition / 2005	O'Reilly

- Online Resources (Open Source)**

Sr. No.	Description of Resource(s)	Weblink
1	NCBI Bioinformatics Resources	https://www.ncbi.nlm.nih.gov
2	Java Tutorials (W3Schools)	https://www.w3schools.com/java
3	Oracle Java Documentation	https://docs.oracle.com/javase
4	Online Courses (Khan Academy / Coursera)	https://www.khanacademy.org / https://www.coursera.org



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Course Type	Course Code	Course Title	Teaching-Learning Scheme	Total Notional Hours	Course credits
			L-P-T		
DSC	P2T01NCBIF05	Practical's based on IT and Cell biology	0-8-0	120	04

• Course Learning Outcomes (CLOs)

On completion of this course, students will be able to:

CLO1: Understand basic computer applications including Microsoft Word, presentations, DOS, DIA, and Linux environments.

CLO2: Apply document formatting and spreadsheet functions to create professional documents such as curriculum vitae and mark sheets.

CLO3: Develop flowcharts using DIA software to represent algorithms for problem-solving such as factorial, prime numbers, and largest number.

CLO4: Perform laboratory techniques including preparation of stains, staining methods, and microbiological media preparation.

CLO5: Analyze biological samples using techniques like spectrophotometry, hemocytometer cell counting, and karyotype study.

CLO6: Examine cell structures and processes through microscopic observation of mitosis, meiosis, and various microorganisms, along with applying sterilization and culturing techniques.

Practical Content	Learning Pedagogies*	CLO(s)
1. Introduction to Microsoft Word & Presentation, DOS, DIA & Linux. 2. Create an application and prepare a neat curriculum Vitae for applying a job in a company. Apply Page format and Paragraph format to the above document and take the hard copy. 3. Prepare a mark list and find out Grade of each subject using functions and take the hard copy (Apply cell insertion deletion and merge). 4. Write steps for making flowcharts in Dia and make a flow chart on finding out largest among 3 numbers. 5. Create a flow chart for finding factorial of a number using dia*. 6. Create flowchart for finding prime number using dia*. 7. Preparation of different types of stains 8. Different types of staining techniques 9. Estimation of DNA and Protein: Spectrophotometric way 10. Cell count determination: using Hemocytometer 11. Examination of various stages of mitosis and meiosis 12. To study cell structure from onion leaf peels, Hydrilla, Spirogyra, Amoeba, Paramecium and Euglena 13. Preparation of Media, Streaking, Spread Plating, Pour Plating, Gram Staining	Demonstration-based, Laboratory Teaching, Hands-on Practical / Experimental Learning, Problem-solving, Application-based Learning	CLO1 to CLO6



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14. Preparation of media, cotton plugging and sterilisation techniques.

• (*) Learning Pedagogies/Methods

Notes:

- The following list is suggestive. Any other learning pedagogies relevant to discipline-specific requirements can be added.
- Acronyms/abbreviations of the terms can be placed in the above table.

- Interactive Classroom Lecture
- Classroom Lecture (CL)
- Seminars (Student-led and Faculty-moderated)
- Micro-Projects/Mini Research Tasks
- Industrial Visit/Field Visit/Institutional Visit
- Problem-Based Learning (PBL)
- Research-Oriented Learning (Literature Review, Tool Construction, Data Analysis Exercises)
- Collaborative Learning (Group Tasks, Peer Discussion, Joint Presentations)
- Experiential Learning (Community Engagement, Internship-linked Activities, Practice-based Tasks)
- ICT-Enabled Learning (LMS-based Tasks, Digital Resources, Virtual Labs/Webinars)
- Reflective Practices (Learning Journals, Reflective Notes, Concept Mapping)
- Self-Directed Learning (Guided Readings, Concept Exploration Tasks)

• Assessment Methodologies

(A) Internal Assessment

a. Internal Formative assessment (30)

- Quiz
- Assignment
- Seminar/Presentation
- Group Task
- Attendance

b. Internal Summative Assessment (20)

- Mid -Term

(B) External Assessment (50)

- End-Term

(B) Weightage of Learning Efforts for External Assessment

Aligned COs	Total Learning Hours	Approximate weightage (Marks) to Learning levels (BT)			Total Marks
		Remember (R)	Understanding (U)	Application/Analyse & above (A)	
CLO1 to CLO6	120	5	5	35	50
	120	5	5	35	50



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(D) CLOs – PLOs Matrix

CLO	PLO									
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	3	2	-	-	-	-	-	-	-	-
CLO2	3	3	2	-	-	-	-	-	-	-
CLO3	2	3	3	2	-	-	-	-	-	-
CLO4	-	2	3	3	2	-	-	-	-	-
CLO5	-	2	3	3	2	-	-	-	-	-
CLO6	-	2	3	3	2	-	-	-	-	-

Values to CLO-PLO matrix are assigned by judging the importance of the particular CLO in relation to the PLOs.

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-

• Suggested Learning Materials Books:

Sr. No.	Title	Author(s)	Edition/Year	Publisher
1	Microsoft Office 2016 Step by Step	Joan Lambert & Curtis Frye	2016	Microsoft Press
2	Bioinstrumentation	L. Veerakumari	2010	MJP Publishers
3	Microbiology: An Introduction	Gerard J. Tortora et al.	11th Edition / 2013	Pearson
4.	Practical Manual of Microbiology	Aneja K.R.	2012	New Age International

• Online Resources (Open Source)

Sr. No.	Description of Resource(s)	Weblink
1	Microsoft Office Tutorials	https://support.microsoft.com
2	Linux Tutorials	https://www.tutorialspoint.com/linux
3	DIA Diagram Software Guide	https://wiki.gnome.org/Apps/Dia
4	Microbiology Virtual Labs	https://vlab.amrita.edu



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Course Type	Course Code	Course Title	Teaching-Learning Scheme	Total Notional Hours	Course credits
			L-P-T		
DSC	P2T01NCBIF06	Fundamentals of Cell Biology	2-0-1	60	02

• Course Learning Outcomes (CLOs)

On completion of this course, students will be able to:

CLO1: Explain the structure and functions of prokaryotic and eukaryotic cells, highlighting key differences and cellular components.

CLO2: Describe the organization of DNA and chromosomes, the regulation of the cell cycle.

CLO3: Analyze patterns of inheritance and identify the genetic basis of common hereditary disorders.

CLO4: Explain the structure and functional roles of major biomolecules, including proteins, lipids, and carbohydrates.

CLO5: Interpret key cellular processes such as cellular respiration and signaling pathways, and their roles in maintaining cell function.

CLO6: Evaluate molecular interactions, and forces responsible for protein structure and stabilization.

Unit	Course Content	Learning Pedagogies*	CLO(s)
I	<u>Cell Biology, Plasma Membrane and Cell Organization</u> Introduction to Cell Biology: Definition and history of cell biology, interrelation of cell biology with other biological sciences, general account of prokaryotic and eukaryotic cells, evolution of eukaryotic cells from prokaryotes, structure of plant and animal cells with brief differences. Plasma membrane: general features and chemical composition of cell membrane, cell membrane models (bilayer and micellar models), functions of cell membrane, junctional complexes (cell junctions). Cell wall: structure and chemical composition, formation of cell wall and its functions. Cell organelles include mitochondria, chloroplast and endoplasmic reticulum with their ultrastructure and functions.	Lecture-based learning, ICT-enabled learning, Inquiry-based learning, Collaborative learning	CLO1, CLO2, CLO3
II	<u>Cell Organelles, Cytoskeleton and Cell Division</u> Cell organelles include Golgi complex, ribosomes, lysosomes and peroxisomes with ultrastructure and functions, and vacuoles and ergastic substances. Cytoskeleton includes microtubules with structure, chemical composition and functions, microfilaments and intermediate filaments with structure, composition and functions, centrioles and basal bodies with structure and functions, and cilia and flagella with structure, movement and locomotion. Nucleus includes ultrastructure and functions. Cell division includes cell cycle, mitosis, meiosis, significance of mitosis and meiosis, and differences between mitosis and meiosis.	Lecture method, ICT-enabled learning	CLO4, CLO5, CLO6



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• (*) Learning Pedagogies/Methods

Notes:

- The following list is suggestive. Any other learning pedagogies relevant to discipline-specific requirements can be added.
- Acronyms/abbreviations of the terms can be placed in the above table.

- Interactive Classroom Lecture
- Classroom Lecture (CL)
- Seminars (Student-led and Faculty-moderated)
- Micro-Projects/Mini Research Tasks
- Industrial Visit/Field Visit/Institutional Visit
- Problem-Based Learning (PBL)
- Research-Oriented Learning (Literature Review, Tool Construction, Data Analysis Exercises)
- Collaborative Learning (Group Tasks, Peer Discussion, Joint Presentations)
- Experiential Learning (Community Engagement, Internship-linked Activities, Practice-based Tasks)
- ICT-Enabled Learning (LMS-based Tasks, Digital Resources, Virtual Labs/Webinars)
- Reflective Practices (Learning Journals, Reflective Notes, Concept Mapping)
- Self-Directed Learning (Guided Readings, Concept Exploration Tasks)

• Assessment Methodologies

(A) Internal Assessment

a. Internal Formative assessment (15)

- Quiz
- Assignment
- Seminar/Presentation
- Group Task
- Attendance

b. Internal Summative Assessment (10)

- Mid –Term
-

(B) External Assessment (25)

- End-Term
-

(B) Weightage of Learning Efforts for External Assessment

Unit	Aligned COs	Total Learning Hours	Approximate weightage (Marks) to Learning levels (BT)			Total Marks
			Remember (R)	Understanding (U)	Application/ Analyse & above (A)	
I	CLO1, CLO2, CLO3	30	1	1	12	14
II	CLO4, CLO5, CLO6	32	1	1	10	12
		60	02	02	22	26



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Assessment and Evaluation

Sr.No.	Assessment/Evaluation	Component	Weightage (%)
1	Continuous Internal Evaluation	Seminars, Assignments, Quizzes, Class Regularity,	50%
2	End-Semester Examination	Written Exam/Practical Exam Project Evaluation (Report, Presentation, Viva)	50%

(E) CLOs – PLOs Matrix

CLO	PLO									
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	3	2	-	-	-	-	-	-	2	-
CLO2	2	3	2	-	-	-	-	-	3	-
CLO3	-	2	3	2	-	-	-	-	2	1
CLO4	-	-	2	3	2	-	-	-	3	2
CLO5	-	-	-	2	3	2	-	-	2	3
CLO6	-	-	-	-	2	3	2	2	-	2

Values to CLO-PLO matrix are assigned by judging the importance of the particular CLO in relation to the PLOs.

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-

Suggested Learning Materials Books:

Sr.No.	Title	Author(s)	Edition/Year	Publisher
1	Molecular Biology of the Cell	Bruce Alberts, Alexander Johnson, Julian Lewis, David Morgan, Martin Raff, Keith Roberts, Peter Walter	6th Edition / 2014	Garland Science
2	Cell Biology	C. B. Powar	3rd Edition / 2005	Himalaya Publishing House
3	Essential Cell Biology	Bruce Alberts, Dennis Bray, Karen Hopkin, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter	4th Edition / 2013	Garland Science

Online Resources (Open Source)

Sr.No.	Description of Resource(s)	Weblink
1	NCBI Bookshelf (Cell Biology Resources)	https://www.ncbi.nlm.nih.gov/books
2	Biology Learning Platform (Khan Academy)	https://www.khanacademy.org/science/biology
3	Cell Biology Research Articles (Nature)	https://www.nature.com/subjects/cell-biology
4	Encyclopedia Resource (Britannica)	https://www.britannica.com/science/cell-biology



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