



**Department of Biotechnology**  
**R.V. College of Engineering, Bengaluru-560059**  
 (An autonomous institution affiliated to VTU, Belagavi)

**Lesson Plan**

**Semester: III**

<b>Course Title:</b> Cell and Molecular Biology	<b>Course Code:</b> BT233A1
<b>Credits:</b> 4	<b>Core/Elective:</b> Core
<b>Type of Course:</b> Basics of Biotechnology	<b>Total Contact Hours:</b> 45L+30P
<b>SEE Marks:</b> 100 + 50	<b>CIE:</b> 100 + 50
<b>Lesson Plan Author:</b> Ashok Kumar HG	<b>Date:</b> 24/09/2025

**Prerequisites:** Basic knowledge of Biology.

**Expected Course Outcomes:**

After going through this course, the student will be able to:

- CO1: Acquire knowledge of various molecular mechanisms/processes of the cell.
- CO2: Compare and contrast various cellular and molecular mechanisms of the cell.
- CO3: Apply techniques required for the isolation, culture, and manipulation of cells, and detection of proteins/DNA/enzymes/antigens/antibodies in the sample.
- CO4: Analyse and articulate the biological information, design experiments, and interpret the results.

Sl. No	Topic	Sub Topics	No. of Hrs	CO	Activity & material s to be used	Book Ref. No.
1	Cell	Structure of prokaryotic and eukaryotic cell	1	1,2	Blackboard/PPT /video/ Flipped classroom	1
		DNA as the Genetic Material: Griffith/HersheyChase experiments	2	1,2		1
		Cell cycle and its regulation, mitosis and meiosis.	3	1,4		1, 2, 5,6
		Cell signalling: Reception, Transduction and Response	4	2,4		1, 2, 5,6
		Programmed cell death	5	2,3,4		1, 2, 5,6
		Structure and functions of Chloroplast	6 & 7	1, 2, 3,4		1,2
		Structure and functions of Mitochondrion	8	2,3,4		1,2
2	Central Dogma of Molecular Biology	Replication of DNA in Prokaryotic cell and Eukaryotic Cell.	1	2,3,4	Blackboard/PPT /video/ Flipped classroom	1, 2, 5,6
		Mechanism of action of Telomerase, DNA damage and repair: Base excision repair	2	2,3,4		1, 2, 5,6
		Mismatch excision repair, photo-reactivation, nucleotide excision, and SoS repair	3	2,3,4		1, 2, 5,6
		Homologous & non-homologous recombination, Transposons: DNA Transposons and retrotransposons.	4	2,3,4		1, 2, 5,6
		Transcription in the prokaryotic cell, and eukaryotic cell. Processing of mRNA	5 & 6	2,3,4		1, 2, 5,6
		Translation in the Prokaryotic and eukaryotic cell	7 & 8	2,3,4		1, 2, 5,6
		Post-Translational modification of proteins	9	2,3,4		1, 2, 5,6
		Secretory and nonsecretory (chloroplast and mitochondria) protein-sorting pathways in eukaryotic cells.	10	2,3,4		1, 2, 5,6
		Regulation of gene expression in prokaryotes (lacoperon and trp-operon)	1	1,2,4		1, 2, 5,6
3	Gene Regulation	Positive and negative gene regulation, mechanism of riboswitches.	2	2,3,4	Blackboard/PPT /video/ Flipped classroom	1, 2, 5,6
		Regulation of gene expression in eukaryotes: Transcriptional control, RNA processing control, Translational control, and post-translational level control.	3 & 4	3,4		1, 2, 5,6
		Hormonal (Steriod hormone, auxin, and Gibberellic acid) control of gene expression in eukaryotes.	5	3,4		1, 2, 5,6
		Gene silencing: antisense techniques, RNA interference, Ribozymes.	6 & 7	2,4		1, 2, 5,6
		Genome editing systems (CRISPR/Cas9, Zinc finger nucleases and TALENs).	8 & 9	2,4		1, 2, 5,6

4	Microbiology	Structure of Bacteria ( <i>Escherichia coli</i> ), blue green algae (Spirulina), Fungi (Saccharomyces cerevisiae), Protozoa (Amoeba), and Viruses (Bacteriophage, Coronavirus).	1 & 2	1, 2	Blackboard/PPT /video	4
		Horizontal genetic transfer in bacteria: conjugation, transformation and transduction.	3	2		4
		Culture of microorganisms: Nutrient media preparation, sterilization of media, isolation of microorganisms from soil sample.	4 & 5	2,3		4
		Growth and measurement of Bacteria.	6	3		4
		Replica plating technique, Simple and Differential (Gram) staining techniques.	7	3, 4		4
		Beneficial microflora for humans, agriculture, environment and industry.	8	4		4
		Human diseases caused by fungi, protozoa, bacteria and viruses.	9	4		4
5	Immunology	Immune system, Innate and adaptive Immune response	1 & 2	1,2	Blackboard/PPT /video/ Flipped classroom	3
		Human antibody: structure, types and functions	3	2,3		3
		Vaccines: Inactivated, attenuated, viral vector, protein subunit, DNA and RNA vaccines.	4&5	3		3
		Cancer: Causes and genetics, Oncogenes, tumour suppressor genes, signalling pathways in tumorigenesis.	6 &7	4		1, 2, 3, 5
		Techniques: Immunofluorescence, rocket immunoelectrophoresis (RIEP), Radio-immunoassay, and ELISA.	8 & 9	4		3

Days	Lab Experiments	Course Outcomes (CO)
1	Isolation of microorganisms from soil samples by serial dilution technique: spread plate, streak plate, and pour plate technique.	Equal weightage given to all the COs
2	Culture of microorganisms: Study of bacterial growth curve	
3	Staining of microorganisms– simple (fungi) and differential (Gram) staining.	
4	Isolation of cellulase/pectinase/amylase producing microorganisms from soil sample.	
5	Antibiotic sensitivity testing of bacteria.	
6	Isolation of genomic DNA from Bacteria.	
7	Isolation of chloroplasts from plant cells.	
8	Study of divisional stages of mitosis and meiosis in plants (onion).	
9	Rocket immunoelectrophoresis (RIEP).	
10	Enzyme Linked Immunosorbent Assay (ELISA).	

### Experiential learning

#### **Innovative Projects:**

1. Isolation of industrially important microbes.
2. Production of useful compounds from microbes.
3. Plant-microbe interaction
4. Formulation of biopesticides
5. Formulation of biofertilizers
6. Detection of microbial contamination in water and food
7. Isolation of genomic DNA from bacteria/plant/animal cells.
8. Extraction of total proteins from plant seeds.
9. Early detection of diseases in plants/humans.

Students can pick up any one project as part of experiential learning

#### **Reference Books:**

1.	Molecular Cell Biology, Lodish H, Berk A, Kaiser CA, Krieger M, Bretscher A, Ploegh H, Martin KC, Yaffe M, Amon A, 9 <sup>th</sup> edn, 2021, MacMillan, ISBN-978-1319426736, ISBN-9781319365042.
2.	Karp's Cell and Molecular Biology. Janet Iwasa and Wallace Marshall, 9 <sup>th</sup> edn, 2020, John Wiley & Sons Inc, ISBN-13: 978-1119598244
3.	Kuby Immunology. Punt J, Stanford S, Jones P, Owen JA, 8 <sup>th</sup> edn, 2018, W.H. Freeman Publication, ISBN 10: 1319114709, ISBN-13: 978-1319114701.
4.	Prescott's Microbiology, Willey J, Sandman K, Wood D, 12 <sup>th</sup> edn, 2022, , McGraw Hill, ISBN-10: 1265123039.

#### **Additional reference books:**

5. Molecular Biology, Clark DP, Pazdernik NJ, McGehee MR, 3<sup>rd</sup> Edn, 2018, Academic Press, ISBN-10: 0128132884
6. Molecular Biology of the Cell, Alberts B, Heald R, Johnson A, 7<sup>th</sup> Edn, 2022, WW Norton & Co, ISBN-10: 0393884856

<b>Rubric for the continuous internal Evaluation (Theory)</b>		
1.	Quizzes: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each quiz will be evaluated for 10 marks adding up to 20 marks. The Sum of Two quizzes will be considered as final quiz marks.	20
2.	Tests: Students will be evaluated in test consisting of descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analysing, Evaluating, and creating). Two Tests will be conducted. Each test will be evaluated for 50 marks, adding up to 100 marks. Final Test Marks Will be reduced to 40 marks.	40
3.	Experiential Learning: Students will be evaluated for their creativity and practical implementation of the problem. Phase I (20) & Phase II (20) Adding up to 40 Marks.	40
4.	Lab: Conduction of Laboratory exercise, lab report, observation, and analysis (30 marks), lab test (10 Marks) and Innovative experiment/ Concept design and Implementation (10 Marks) adding up to 50 Marks. The Final Marks will be 50 marks	50
	Maximum Marks For The CIE Theory	150

<b>Rubric For The Semester End Examination (Theory)</b>		
Q.No.	Contents	Marks
<b>PART A</b>		
1	Objective type questions covering entire syllabus	20
<b>PART B</b> (Maximum of Two Sub-Divisions only)		
2	Unit 1: (Compulsory)	16
3 & 4	Unit 2: Question 3 or 4	16
5 & 6	Unit 3: Question 5 or 6	16
7 & 8	Unit 4: Question 7 or 8	16
9 & 10	Unit 5: Question 9 or 10	16
	Total	100

<b>Rubrics For Semester End Examination (Lab)</b>		
Q.No.	Contents	Marks
1	Write Up	10
2	Conduction of the Experiment	30
3	Viva	10
	Total	50

CO-PO Mapping											
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>CO1</b>	2	-	-	-	-	-	-	-	1	-	2
<b>CO2</b>	1	-	-	-	-	-	-	-	2	-	2
<b>CO3</b>	1	1	2	1	2	1	-	2	1	-	2
<b>CO4</b>	2	3	2	2	2	1	-	2	2	-	2

High-3 : Medium-2 : Low-1

**Faculty In-charge**

**Head of Department**

**Date:**