

DEPARTMENT OF BOTANY				CLASS: I M.Sc. Botany				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
II	Major Core 4	21P2BMC4	Cell and Molecular Biology	4	5	25	75	100

Nature of Course			
Knowledge and skill	✓		Employability oriented
Skill oriented	✓		Entrepreneurship oriented

### Course Objectives:

1. To understand the structural, biochemical and functional basis of cell and its components.
2. To explain the molecular basis of inheritance that governs plant development.
3. To study the general principles of gene expression and its regulation.

Units	Contents	CLO	K Level	Hours
I	Cell Theory - Ultra structure & organization of Prokaryotic and Eukaryotic cells - Plant cell structure and functions: Cell wall, Plasma membrane, Nucleus, Mitochondria, Golgi bodies, Lysosomes, Endoplasmic reticulum, Peroxisomes, Plastids and Vacuoles - Ontogeny of mitochondria and chloroplast - Molecular basis for cell wall mediated signaling mechanisms and cell-to-cell interaction in a parasitic plant and its hosts - Endocytosis and Exocytosis.	CLO 1	Up to K4	15
II	Cell Growth and Division - Mitosis and Meiosis - Phases of cell cycle, cell cycle control and regulation system - Regulation of plant cell cycle - Classification, physical and chemical structure of Nucleic acids - Forms of DNA and types of RNA, siRNA, PNA, RNAi, Mitochondrial and Chloroplast DNA - DNA synthesis and Replication models, Termination of replication, Enzymes of DNA replication, Methylation of DNA, DNA binding protein, Histones - Programmed cell death.	CLO 2	Up to K4	15
III	Central Dogma of Life - RNA Synthesis and Processing - Transcription factors and Machinery, Formation of initiation complex, Transcription activator and repressor, RNA Polymerases - Initiation, Elongation and Termination - Post transcriptional modification (Capping, Polyadenylation and Splicing) - RNA editing - RNA transport. Genetic Code - Protein Synthesis and Processing: Aminoacylation of tRNA, Aminoacyl tRNA synthetase, Formation of initiation complex, Initiation factors and their regulation, Elongation and elongation factors, Termination and	CLO 3	Up to K4	15

	Translational proof-reading, Translational inhibitors - Post translational modification of proteins.			
IV	Control of gene expression at transcription and translation level - Regulating the expression of prokaryotic (lac and trp operon) and eukaryotic gene ( <i>rbcL</i> gene in plants), Role of chromatin in gene expression and gene silencing. Recombination: Homologous, Non homologous and Site specific recombination - Molecular Chaperons - Heat Shock proteins - Oncogenes and anti-oncogenes.	<b>CLO 4</b>	Up to K4	<b>15</b>
V	Development of cell signaling, hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers and regulations of signaling pathways - Transposons and types - Gene mapping methods: Linkage maps, Tetrad analysis, Mapping with molecular markers, Mapping by somatic cell hybrids - DNA repair mechanisms: Photo activation, Excision repair, Recombination repair, SOS repair, Adaptive responses and their regulation.	<b>CLO 5</b>	Up to K4	<b>15</b>

#### Books for Study:

1. Ajoy Paul, (2009). Text book of Cell and Molecular Biology, Books and Allied (P) Ltd Kolkata.
2. Verma P.S. and Agarwal V.K. (2007). Cell Biology, Genetics, Molecular Biology and Evolution, S. Chand and company Ltd, New Delhi.
3. David Freifelder, (1985). Essentials of Molecular Biology. Narosa Publishing House, New Delhi.

#### Books for References:

1. Archana Sharma. (1985). 2<sup>nd</sup> Ed. Chromosomes. Oxford and IBH Publishing Company.
2. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter (2002). Molecular biology of the cell (IV Edn). Garland Science, Taylor and Francis group, New York.
3. Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
5. Gardner, E.J., Simmons, M.J. and Snustad, D.P. (1991). Principles of Genetics (III Edn). John Wiley and Sons Inc., India.
6. Geoffrey M. Cooper. (1997). The Cell - A Molecular approach. ASM Press, Washington.
7. Gerald Karp (2008). Cell and Molecular biology: Concepts and experiments (V Edn). John Wiley & Sons, India.
8. Grierson, D. and Covey, S.N. (1984). Plant Molecular Biology. Blackie and sons, London.
9. Kumar, H.D. (1999). Molecular Biology. Vikas Publishing House Pvt. Ltd. New Delhi.
10. Walker J.M and Rapley, R (2006). Molecular Biology and Biotechnology (4th Edn) Panima Publishing Corporation, New Delhi.

11. Wayne M Becker, Lewis J Kleinsmith, Jeff Hardin. (2007). The world of the cell (VI Edn). Pearson.
12. B. Buchanan, W.Gruissem, R. Jones (Eds). (2000). Biochemistry & Molecular Biology of Plants, American Society of Plant Physiology, Rockville, MD.

**Web Resources:**

1. <https://epgp.inflibnet.ac.in/>
2. <https://www.sciencedirect.com>
3. <https://epathshala.nic.in/>
4. <https://www.biologydiscussion.com>

**Rationale for Nature of the Course:**

This course will enable the students to know the basis of cellular components, molecular basis of inheritance and the general principles of gene expression and its regulation.

**Activities having direct bearing on Skill development / Employability / Entrepreneurship:**

The knowledge learned by the students will help them to understand the various cellular organelles and their function, different phases of cell cycle, central dogma of life, gene expression control and gene mapping.

**Pedagogy:**

Chalk and Talk, Power Point, Group Discussion, Seminar, Interaction, Problem Solving, Quiz, Virtual Labs, Video Clippings, Google Classroom & LMS (CANVAS).

**Course Designer:**

**Dr. N. Janakiraman, Assistant Professor**

## Lecture Schedule

Unit	Description	Hours	Mode
1	Cell theory, Ultra structure & organization of Prokaryotic and Eukaryotic cells	2	Chalk and Talk, Power Point, Discussion, Seminar, Interaction, Quiz, Video Clippings & Google classroom.
	Plant cell structure and functions: Cell wall, Plasma membrane	2	
	Nucleus, Mitochondria, Golgi bodies	3	
	Lysosomes, Endoplasmic reticulum, Peroxisomes, Plastids and Vacuoles	3	
	Ontogeny of mitochondria and chloroplast	2	
	Molecular basis for cell wall mediated signaling mechanisms and cell-to-cell interaction in a parasitic plant and its hosts	2	
	Endocytosis and Exocytosis	1	
2	Cell Growth and Division, Mitosis and Meiosis	2	Chalk and Talk, Power Point, Discussion, Seminar, Interaction, Quiz, Video Clippings & Google classroom.
	Phases of cell cycle, cell cycle control and regulation system	2	
	Regulation of plant cell cycle	1	
	Classification, physical and chemical structure of nucleic acids	2	
	Forms of DNA and types of RNA, siRNA, PNA, RNAi	2	
	Mitochondrial and Chloroplast DNA	1	
	DNA synthesis and Replication models	2	
	Termination of replication, Enzymes of DNA replication	1	
	Methylation of DNA, DNA binding protein	1	
Histones, Programmed cell death	1		
3	Central Dogma of Life, RNA Synthesis and Processing	1	Chalk and Talk, Power Point, Discussion, Seminar, Interaction, Quiz, Video Clippings & Google classroom.
	Transcription factors and Machinery	1	
	Formation of initiation complex, Transcription activator and repressor	1	
	RNA Polymerases, Initiation, Elongation and Termination	3	
	Post transcriptional modification (Capping, Polyadenylation and	3	
	Genetic Code, Protein Synthesis and Processing, Aminoacylation of	2	
	Formation of initiation complex, Initiation factors and their regulation, Elongation and elongation factors	2	
Termination and Translational proof-reading, Translational	2		
4	Control of gene expression at transcription and translation level	2	Chalk and Talk, Power Point, Discussion, Seminar, Interaction, Quiz, Video Clippings & Google classroom.
	Regulating the expression of prokaryotic (lac and trp operon) and	4	
	Role of chromatin in gene expression and Gene silencing	2	
	Recombination: Homologous, Non homologous and Site specific recombination	3	
	Molecular Chaperons, Heat Shock proteins	2	
	Oncogenes and anti-oncogenes	2	
5	Development of cell signaling, hormones and their receptors	2	Chalk and Talk, Power Point, Discussion, Seminar, Interaction, Quiz, Video Clippings & Google classroom.
	Cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers and regulations of signaling pathways	3	
	Transposons and types	2	
	Gene mapping methods: Linkage maps, Tetrad analysis, Mapping	4	
	DNA repair mechanisms: Photo activation, Excision repair, Recombination repair, SOS repair, Adaptive responses and their regulation.	4	

**Course Learning Outcomes:**

On successful completion of the course, the

CLOs	CLO Statement	Knowledge Level
<b><u>Students will be able to know, understand, apply, and analyse</u></b>		
<b>CLO 1</b>	The various components of cell and their functions	Up to K4
<b>CLO 2</b>	The different phases of cell cycle and their regulation	Up to K4
<b>CLO 3</b>	The molecular basis of inheritance that governs plant development	Up to K4
<b>CLO 4</b>	The general principles of gene organization and expression at transcriptional and translational level	Up to K4
<b>CLO 5</b>	The cell signaling pathways and gene mapping	Up to K4

**Mapping Programme Specific Outcomes with Course Learning Outcomes:**

#	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
<b>CLO 1</b>	2	3	3	1	2
<b>CLO 2</b>	2	3	3	2	2
<b>CLO 3</b>	1	3	3	2	3
<b>CLO 4</b>	1	2	3	2	2
<b>CLO 5</b>	1	2	3	2	3

3 - Advance Application; 2 - Intermediate Level; 1 - Basic Level

**PG Botany Blue Print**

Test	10 marks	As per table below
Assignment	5 marks	K4
Seminar	5 marks	K4
Quiz	5 marks	K4

**Learning Outcome Based Education (LOBE) & Assessment**

**Formative – Blue Print**

**Articulation Mapping-K Levels with Courses Learning Outcomes (CLOs)**

Units	CLOs	K- Level	Section A		Section B (Either/or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K- Level		
1	CLO x	Up to K3	2	K2,K3	2 (K3&K3)	2 (K2,K3)
2	CLO y	Up to K4	3	K2, K2, K3	2 (K4&K4)	1 (K3/K4)
No. of Questions to be asked			5		4	3
No. of Questions to be answered			5		2	2
Marks for each question			2		5	10
Total Marks for each section			10		10	20

**Learning Outcome Based Education (LOBE) & Assessment**

**Summative Examination – Blue Print**

**Articulation Mapping-K Levels with Courses Learning Outcomes (CLOs)**

Units	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K2	2	K1 & K1	1	K1	2 (K1&K1)	1 (K2)
2	CLO 2	Up to K3	2	K2 & K3	1	K1	2 (K2&K2)	1 (K3)
3	CLO 3	Up to K4	2	K2 & K3	1	K2	2 (K3&K3)	1 (K3)
4	CLO 4	Up to K4	2	K3 & K4	1	K2	2 (K4&K4)	1 (K4)
5	CLO 5	Up to K4	2	K3 & K4	1	K3	2 (K4&K4)	1 (K4)
No. of Questions to be asked			10			5	10	5
No. of Questions to be answered			10			5	5	3
Marks for each question			1			2	5	10
Total Marks for each section			10			10	25	30

**Distribution of Section- wise marks with K Levels in the summative examinations**

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	4	10	-	16	13.33	35%
K2	2	4	10	10	26	21.66	
K3	4	2	10	20	36	30.00	30%
K4	2	-	20	20	42	35.00	35%
<b>Total Marks</b>	10	10	50	50	120	100.00	100%