

DEPARTMENT OF MICROBIOLOGY				CLASS: I M.Sc. Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
II	Major Core - 4	21P2RMC4	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 recall the structure and functions of cell organelles, appreciate the need of cell division in growth and perpetuation of a species
2. To compare the structure and types of DNA
3. To differentiate transcription in prokaryotes and eukaryotes
4. To explain the protein synthesis and post translational modifications
5. To analyze the significance of mutation in the evolution of species

Course Learning Outcomes

On successful completion of the programme, the students will be able to

1. Compare the structure of cell organelles with their function and explain the importance of cell division in organisms
2. Illustrate the different types of DNA
3. Distinguish the transcription in prokaryotes and eukaryotes
4. Compile the protein synthesis and Post translational modifications
5. Justify the significance of mutation in the evolution of species

Unit	Description	Hours	K- level	CLO
I	Unit I Cells and Cell Cycle Structure, composition and function of cell and cell organelles – cell membrane, nucleus, nucleolus, endoplasmic reticulum, golgi apparatus, ribosomes, lysosomes, mitochondria, chloroplast, peroxisomes, microtubules. Cell cycle-(G0, G1, G2, S and M phases) and its checkpoints. Cell division- Mitosis and Meiosis.	15 hrs	Up to K2	1
II	Unit II Structure and Replication of DNA Structure and properties of DNA. Different forms of DNA-A, B and Z, Supercoiling of DNA. DNA replication – enzymes involved mechanism and types of DNA replication-conservative, semiconservative and dispersive. Modes of replication -Q mode, D model, rolling circle model, Bidirectional and Unidirectional.	15 hrs	Up to K3	2

III	Unit III Transcription Components and function of RNA polymerase. Transcription in prokaryotes - initiation, elongation, and termination. Transcription in eukaryotes - RNA polymerase –promoters, enhancers and silencers. Post transcriptional modifications- splicing, addition of 5'cap, creation of poly AAA and RNA editing. Antisense RNA technique and its applications.	15 hrs	Up to K3	3
IV	Unit IV Translation Genetic code. Wobble hypothesis. Functions of tRNA, rRNA, mRNA. Protein synthesis- initiation, elongation and termination. Post translational modifications- phosphorylation, glycosylation, ubiquitination, nitrosylation, methylation, acetylation, lipidation and proteolysis. Molecular chaperons.	15 hrs	Up to K4	4
V	Unit V Mutation Mutation - spontaneous and induced types of mutation- substitutions, deletions, insertions missense, nonsense, insertion, deletion, duplication, frameshift, repeat expansion. Mutagens- physical, chemical and biological mutagens. Molecular mechanisms of mutagenesis, Methods of directed mutagenesis. Repair mechanism- photo reactivation and SOS.	15 hrs	Up to K4	5

Total 75 hours

Books for study:

1. Old, R.S. and Primrose, S.B. (1995). Principles of Gene manipulation. 5th Edition. Blackwell Scientific Publication, London.
2. Click, B.R. and Pasternat, J.J. (1994). Molecular Biotechnology. ASM press. Washington DC.

Books for reference:

1. Lewin, B. (1997). Genes VI. Oxford University Press, London.
2. David, B.D., Delbecco, R., Eisen, H.N. and Ginsburg, H.S. (1990). Microbiology. 5th Edition. Harper & Row, New York.

Web Resources

1. https://bio.libretexts.org/Bookshelves/Cell_and_Molecular_Biology
2. <https://web.uri.edu/cmb/cell-and-molecular-biology/>
3. <https://www.nature.com/scitable/topic/cell-biology-13906536/>
4. <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/cell-biology>
5. <https://www.microscopemaster.com/cell-biology.html>

Rationale for nature of the course

Cell and molecular biology course will help to understand the structure and function of the basic unit of life. This field explores the relationships between cell processes and reactions, macromolecules and gene control pathway. The study of molecular cell biology enables students to understand how cell programs and reactions function normally as well as the relationships between those processes and gene expression.

Activities having direct bearing on skill development/ employability/entrepreneurship

Students will be able to understand and integrate knowledge of chemical and biological principles of living systems.

Students will develop quantitative skills in order to collect, analyse and interpret experimental data.

Understanding how genes are inherited through meiosis and fertilization.

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Screening of educational videos and quiz

Course Learning Outcomes (CLO)

On the completion of the course the student will be able to

CLOs	Course Learning Outcome	Knowledge Level
CLO1	Compare the structure of cell organelles with their function and explain the importance of cell division in organisms	Up to K2
CLO2	Illustrate the different types of DNA	Up to K3
CLO3	Distinguish the transcription in prokaryotes and eukaryotes	Up to K3
CLO4	Compile the protein synthesis and Post translational modifications	Up to K4
CLO5	Justify the significance of mutation in the evolution of species	Up to K4

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	2	1	3	2	3
CLO2	1	1	1	2	2
CLO3	2	2	1	1	3
CLO4	2	2	2	1	2
CLO5	2	2	2	2	2

Advance application-3

Intermediate level -2

Basic level -1

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	1	1	1	1	1
CLO2	1	1	1	1	1
CLO3	1	1	1	1	1
CLO4	1	2	2	2	2
CLO5	2	2	2	2	2

Advance application-3

Intermediate level -2

Basic level -1

Learning Outcome Based Education & Assessment (LOBE)

Blue Print

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	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	K2 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K3	2	K3 & K3	1	K1	2 (K3&K3)	1(K3)
3.	CLO 3	Up to K3	2	K3 & K3	1	K2	2 (K2&K2)	1(K3)
4.	CLO 4	Up to K4	2	K4& K4	1	K2	2 (K4&K4)	1(K4)
5.	CLO 5	Up to K4	2	K1& K1	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

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Distribution of Section-wise Marks with K Levels

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	21.67	
K3	4	2	10	20	36	30	30%
K4	2	-	20	20	42	35	35%
Total Marks	10	10	50	50	120	100.00	100%

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

LESSON PLAN

UNITS	DESCRIPTION	STAFF	HOURS	MODE
I Composition of cells	a) Cell membrane, Nucleus, Nucleolus		3	Chalk and Talk PPT
	b) Endoplasmic Reticulum, Golgi apparatus, Lysosomes, Microtubules.		3	
	c) Mitochondria, Chloroplast, Peroxisomes,		3	
	d) Cell cycle G1,G2,S and Mitosis		3	
	e) Meiotic cell division.		3	
II Nucleic acid DNA	a) Structure and Properties of DNA. Different forms of DNA-A, B and Z		3	Chalk and Talk PPT
	b) Supercoiling of DNA .		2	
	c) DNA replication – Enzymes involved, mechanism		3	
	d) Types of DNA replication-conservative, semiconservative		3	
	e) Dispersive-Q mode, D model, rolling circle model, Bi and uni directional		4	
III Transcription	a) Transcription in prokaryotes RNA polymerase structure-promoters- initiation, elongation, and termination.		5	Chalk and Talk & PPT
	b) Transcription in eukaryotes-RNA polymerase-promoters-enhancers and silencers.		3	
	c) Post transcriptional modifications. splicing, addition of 5'cap,creation of poly AAA,RNA editing.		4	
	d) Antisense RNA technique and its applications.		3	
IV Nucleic acid RNA	a) Genetic code, Wobble hypothesis.		3	PPT & Chalk and Talk
	b) Structure of t RNA, r RNA, m RNA		5	
	c) Protein synthesis- initiation, elongation and termination.		2	
	d) Post translational modifications.		5	
V Mutation	a) Mutation: Spontaneous and Induced types of mutation		3	PPT &Chalk and Talk
	b) Types of mutation-substitutions, deletions, insertionsMissense, Nonsense, Insertion, Deletion, Duplication, Frameshift, Repeat expansion.		3	
	c) Mutagens- physical, chemical and biological mutagens. physical mutagens and chemical mutagens.		3	
	d) Molecular Mechanisms of mutagenesis, Methods of directed mutagenesis. .		2	
	e) Repair mechanism- Photoreactivation, SOS		2	
	f) Molecular chaperons.		2	
Total			75 Hours	

Course designers : Dr. A. P. AshaKannan