DEPARTMENT OF BIOTECHNOLOGY				*CLASS: II B.Sc. Biotechnology*				
Sem	**Course Type**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/week**	**CIA**	**Ext**	**Total**
IV	Major Core-6	20U4LMC6	Cell and Molecular Biology	5	5	25	75	100

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

Course Objectives

1.	To equip students with a basic knowledge of the structural and functional properties of cell organelles.
2.	To become aware of various macromolecular complexity and their functions
3.	To provide an overview of the flow of information from genes to proteins.
	To relate the properties of cancerous cells to mutational changes in gene function

Unit	**Description**	**Hours**	**K level**	**CLOs**
I	**Ultrastructure of cell membrane and cell organelle** Ultra structure of cell membrane, cytosol, endoplasmic reticulum - rough and smooth,golgi bodies, ribosomes, cytoskeletal structures - intermediate filaments, microtubules, microfilaments, mitochondria, chloroplast, lysosomes, peroxisomes, nucleus - nuclear membrane, nucleoplasm, nucleolus, differences between prokaryotic and eukaryotic cells.	15	Up to K-3	**3**
II	**Chromosomes and Cell cycle** Chromosome - discovery, morphology, chemical composition, structural organization, centromere, telomere, chromatin, nucleosome organization, eu- and heterochromatin, special chromosomes - polytene, lampbrush chromosomes. Cell division: mitosis and meiosis, interphase, comparison of mitosis and meiosis, cell cycle – phases and regulation. Cancer - characteristic of cancer cells, types – carcinoma, sarcoma, lymphoma.	15	Up to K-3	**3**
III	**Replication and DNA repair** Prokaryotic and eukaryotic DNA replication - mechanism of DNA replication - initiation, replication fork, enzyme machinery of replication, types of DNA replication - rolling circle and bidirectional replication, inhibitors of DNA synthesis. Mutation – molecular mechanism,biological repair mechanism - SOS, Excision, photo reactivation	15	Up to K-4	**4**
IV	**Transcription** Prokaryotic and eukaryotic transcription - RNA polymerases, general and specific transcription factors, transcription process, post transcriptional modifications - 5'cap formation, 3' polyadenylation, splicing, editing and gene silencing. Nuclear export of mRNA, inhibitors of transcription , gene regulation – lac and trp operon.	15	Up to K-2	**2**

V	**Translation** Genetic code - characteristics of genetic code, Wobble hypothesis. Prokaryotic and eukaryotic translation, mechanism - initiation, elongation and termination, post translational modification of proteins, inhibitors of protein synthesis, signal hypothesis.	15	Up to K-4	**4**

Books for Study

1. David Freifelder, 2015. Molecular Biology,4th Edition. Narosa Publishing house New Delhi.
2. Verma and Agarwal, 2016. Cell and Molecular Biology. S.Chand publications, New Delhi.

Books for Reference

1. Tropp BE, 2012. Molecular Biology Genes to proteins. Jones and Bartlett learning.
2. Molecular Biology of the Gene, 6th Edition (2008), James D. Watson, Pearson Education.

Web Resources

http://www.gwumc.edu
http://nptel.ac.in
http://swayam.gov.in

Rationale for Nature of the course

The course focuses on the basic molecular aspects of gene expression.To seek core knowledge on the macromolecular complexity with its structure and function.To gain knowledge on the cell cycle and its regulation and to correlate with the diseased state.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Model making of cell and its organelles and also structure of molecules of life
- Critical reasoning and analysis on molecular basis of inheritance through problem solving.
- Review of topics related to inhibitors of gene expression as therapeutic molecule.

Pedagogy

The teaching methods may include Chalk and talk, PowerPoint, demonstrations, assignments and group discussions and Problem solving.

Course content designers

Ms.R. Suguna
Dr. P. Vimal

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K - Level
CLO-1	Illustrate the structure and function of plasma membrane and cell organelles	Up to K-3
CLO-2	Interpret the importance of cell cycle with cancer	Up to K-3
CLO-3	Compare and contrast the replication process in prokaryotes and eukaryotes	Up to K-4
CLO-4	Explain gene expression and the roles of the promoter, coding and termination sequences	Up to K-2
CLO-5	Analyze the role of enzymes, organelles and molecules involved in translation	Up to K-4

Mapping of Course outcomes with Program Outcomes

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	2	3	2	2
CLO-2	3	2	3	2	1
CLO-3	3	2	3	2	1
CLO-4	3	2	2	2	1
CLO-5	3	2	3	2	1

Advance application-3; Intermediate level-2 & Basic level-1

Mapping of Course outcomes with Program specific Outcomes

CLO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	3	-	2	3
CLO-2	3	3	2	3	2
CLO-3	3	-	-	1	2
CLO-4	3	2	-	2	1
CLO-5	3	3	3	2	2

Advance application-3; Intermediate level-2 & Basic level-1

LESSON PLAN

Unit	Description	Hours	Mode
UNIT - I	Ultra structure of cell membrane, cytosol, endoplasmic reticulum - rough and smooth,golgi bodies, ribosomes	5	Chalk & Talk
	cytoskeletal structures - intermediate filaments, microtubules, microfilaments	5	Chalk & Talk
	mitochondria, chloroplast, lysosomes, peroxisomes, nucleus - nuclear membrane, nucleoplasm, nucleolus	5	Chalk & talk, PPT
UNIT - II	Chromosome - discovery, morphology, chemical composition, structural organization, centromere, telomere, chromatin	5	Discussion & PPT
	Nucleosome organization, eu- and heterochromatin, special chromosomes - polytene, lampbrush chromosomes.	5	Chalk & Talk
	Cell division: mitosis and meiosis, interphase, comparison of mitosis and meiosis, cell cycle – phases and regulation. Cancer - characteristic of cancer cells, types –carcinoma, sarcoma, lymphoma.	5	Chalk & Talk Discussion
UNIT - III	Prokaryotic and eukaryotic DNA replication - mechanism of DNA replication - initiation, replication fork, enzyme machinery of replication,	5	Chalk & talk, PPT
	Types of DNA replication - rolling circle and bidirectional replication, inhibitors of DNA synthesis.	5	Discussion & PPT
	Mutation – molecular mechanism,biological repair mechanism - SOS, Excision, photo reactivation	5	Chalk & Talk
UNIT-IV	Prokaryotic and eukaryotic transcription - RNA polymerases, general and specific transcription factors, transcription process, post transcriptional modifications - 5'cap formation, 3' polyadenylation, splicing, editing and gene silencing.	8	Chalk & Talk Discussion
	Nuclear export of mRNA, inhibitors of transcription, gene regulation – lac and trp operon.	7	Chalk & talk, PPT
UNIT - V	Genetic code - characteristics of genetic code, Wobble hypothesis. Prokaryotic and eukaryotic translation, mechanism - initiation, elongation and termination	9	Chalk and talk. PPT
	Post translational modification of proteins, inhibitors of protein synthesis, signal hypothesis.	6	Chalk and talk. PPT

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Cell and Molecular Biology Course
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

BLUE PRINT FOR INTERNAL ASSESSMENT – I

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 K 3	2	K1 & K2	1	K1	2 (K1&K1)	1(K3)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

BLUE PRINT FOR INTERNAL ASSESSMENT – II

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 3	Up to K 4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
2.	CLO 4	Up to K 2	2	K1 & K2	1	K2	2 (K2&K2)	1(K2)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

Learning Outcome Based Education & Assessment (LOBE)
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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 K 3	2	K1 & K2	1	K1	2 (K1&K1)	1(K3)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
3.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4.	CLO 4	Up to K 2	2	K1 & K2	1	K2	2 (K2&K2)	1(K2)
5.	CLO 5	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
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

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	5	4	10	-	**19**	15.83	**42%**
K2	5	6	10	10	**31**	25.83	
K3	-	-	20	30	**50**	41.67	**42%**
K4	-	-	10	10	**20**	16.67	**16%**
Total Marks	10	10	50	50	**120**	100.00	**100%**

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1Question from Unit-I (K3 Level)
		2 Questions from Unit-II (K3 Level)	1Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K2 Level)	1Question from Unit-IV (K2 Level)
		2 Questions from Unit-V (K4 Level)	1Question from Unit-V (K3 Level)

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