DEPARTMENT OF ZOOLOGY				*CLASS: II B.Sc. Zoology*				
Sem	**Course Type**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/week**	**CIA**	**Ext**	**Total**
III	Core	20U3ZMC5	Cell Biology & Biochemistry	5	5	25	75	100

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

Course Objectives

By the end of the course, students will be able:

1. To understand the cell theory, types of cells and techniques used in cell biology
2. To describe ultrastructure and functions of the cell organelles.
3. To appraise the cell cycle and biochemistry of metabolism in cells.
4. To understand the types and role of RNA and protein synthesis.
5. To give an idea about enzymes and their role in cell metaboilsm.

Unit	Description	Hours	K-level	CLO
I	**Introductory Cytology** Cell theory - Prokaryotic and Eukaryotic cells. Cytological techniques: Fixation– Sectioning & Staining. Principle & uses of compound microscope, confocal microscope and electron microscope. Cell Junctions - Ultrastructure and functions of plasma membrane.	**15**	Up to K-2	**1**
II	**Cell Organelles** Nucleus & Nucleolus. DNA structure and function - DNA Replication - Chromatin – Nucleosome. Chromosomes: – Structure, types, Giant chromosomes. Ultrastructure and functions of Endoplasmic reticulum & Golgi body.	**15**	Up to K-3	**2**
III	**Biochemistry& Cell cycle** Ultrastructure and functions of Lysosomes, Centrosomes, Mitochondria. Glycolysis and Krebs cycle. Electron transport chain and formation of ATP. Cell cycle - Mitosis, Meiosis & interphase its regulation. Apoptosis & Cancer.	**15**	Up to K-3	**3**
IV	**Protein Synthesis** Types & role of RNA- Structure of t-RNA. Ultra structure, function and types of ribosome. Properties of Genetic code - Detailed study of Protein synthesis – Polysome – differences in eukaryotes – Short outline of post transcriptional modifications.	**15**	Up to K-4	**4**
V	**Enzymes & Metabolism** Structure and Classification of Carbohydrates, Protein and lipids. Enzymes: mechanism of action – classification and factors influencing enzyme action – Enzyme Inhibition. Glycogenesis –	**15**	Up to K-4	**5**

	Glycogenolysis, Gluconeogenesis and HMP shunt. Deamination & Transamination. Beta oxidation of fats.			

Books for Study

1. Arumugam, N. 2020. *Cell Biology & Molecular Biology*, Saras Publications, Nagercoil.
2. Arumugam, N. 2014. *Cell Biology*, Saras Publications, Nagercoil.
3. Fatima, D., Narayanan, LM., Meyyan, RP., Nallasingam, K., Prasanna Kumar, S. & Arumugam, N. 2014. *Biochemistry*, Saras Publications, Nagercoil.
4. Verma, PS. & Aggarwal, VK. 2015. *Cell Biology (Cytology, Biomolecules and Molecular Biology)*, S. Chand Publishers, New Delhi.

Books for References

1. De Robertis, EDP. & De Robertis, EMF. 2010. *Cell and Molecular Biology*, Lippincott Williams & Wilkins.
2. Gupta, PK. 2018. *Cell Biology*, Rastogi Publications, Meerut.
3. Jain, JL., Jain, N. & Jain, S. 2016. *Fundamentals of Biochemistry*, S. Chand Publications, New Delhi.
4. Pawar, CB. 2019. *Cell Biology*, Himalaya Publications.
5. Ramadevi, K. 2016. *Ambika Shanmugam's Fundamentals of Biochemistry for Medical Students*, Wolters Kluwer India Pvt Ltd.
6. David L. Nelson & Michael M. Cox, 2017. *Lehninger Principles of Biochemistry*, Macmillan.

Web resources

https://www.shomusbiology.com/cell-biology.html
https://biolympiads.com/notes-of-molecular-biology-of-the-cell-by-alberts/
https://www.biologyjunction.com/cell++notes+bi.htm

Rationale for Nature of the course

This course will enable the students to comprehend the knowledge on concepts of cell theory, ultrastructure and types of cells, advanced techniques used in cell biology, role of cell organelles, phases of cell cycle, biochemistry of metabolism in cells, types and role of RNA, protein synthesis, enzymes and their role in cell metaboilsm.

Activities having direct bearing on Skill development/Employability/Entrepreneurship

The acquired knowledge on the working principles of advanced instruments used in cytology will help the students for developing their skills in cytological techniques, which further paves the way for their employability.

Pedagogy

Chalk and Talk, PPT, group discussion, seminar, interaction, quiz, tutorial and virtual labs.

Course Designers:

1. Dr. B. Latha
2. Dr. C. Selvakumar

Lecture Schedule (Total hours: 75)

Unit	Description	Staff Name	Hrs	Mode
I	Cell theory – Prokaryotic & Eukaryotic cells		3	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Cytological techniques: Fixation– Sectioning & Staining		3	
	Principle & uses of compound microscope, confocal microscope and electron microscope		4	
	Cell Junctions		2	
	Ultrastructure and functions of plasma membrane		3	
			15	
II	Nucleus & Nucleolus		2	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	DNA structure and function		2	
	DNA Replication, Chromatin, Nucleosome.		3	
	Structure & types of Chromosomes		2	
	Giant chromosomes		2	
	Ultrastructure and functions of Endoplasmic reticulum & Golgi body		4	
			15	
III	Ultrastructure and functions of Lysosomes, centrosomes, Mitochondria		4	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Glycolysis & Krebs cycle		4	
	Electron transport chain and formation of ATP		2	
	Cell cycle -Mitosis, Meiosis & Interphase its regulation		3	
	Apoptosis & Cancer		2	
			15	
IV	Types & role of RNA, Structure of t-RNA		3	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Ultra structure, function and types of ribosome		3	
	Properties of Genetic code		3	
	Detailed study of Protein synthesis		3	
	Polysome – differences in eukaryotes		2	
	Short outline of post transcriptional modifications		1	
			15	
V	Structure and Classification of Carbohydrates, Protein & Lipids		4	Lecture, Chalk and Talk, Interaction, PPT & Group Discussion
	Enzymes: mechanism of action, classification and factors influencing enzyme action - Enzyme Inhibition.		4	
	Glycogenesis –Glycogenolysis, Gluconeogenesis and HMP shunt		3	
	Deamination & Transamination		2	
	Beta oxidation of fats		2	
			15	

Course Learning Outcomes:

On successful completion of the course, the student will able to:

CLOs	CLO Statements	Knowledge level
CLO-1	Describe the cell theory, widely used cytological techniques and ultrastructure & functions of plasma membrane.	K2
CLO-2	Discuss the ultrastructure and functions of cell organelles.	K3
CLO-3	Examine the stages of cell cycle and metabolic cycles in mitochondria	K3
CLO-4	Investigate the mechanism of protein synthesis.	K4
CLO-5	Analyze the role of cellular components and enzymes in cell metabolism	K4

Mapping with Programme Specific Outcomes

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8
CLO-1	1	1	2		2		2	
CLO-2	2	2	3				2	
CLO-3	1	1	2				2	
CLO-4	2	1	3			2	2	
CLO-5	3	2	3	2	2	3	3	

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

Mapping with Programme Outcomes

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

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

BLUE PRINT FOR INTERNAL ASSESSMENT - I
Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 1	Up to K 2	2	K1& K2	1	K1	2 (K2&K2)	1(K2)	
2	CLO 2	Up to K 3	2	K1& K2	2	K2	2 (K3&K3)	2(K2/K3)	
No. of Questions to be asked			4		3		4	3	14
No. of Questions to be answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

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 inferences with evidences

BLUE PRINT FOR INTERNAL ASSESSMENT - II
Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 3	Up to K 3	2	K1& K2	1	K1	2 (K2&K2)	2(K2/K3)	
2	CLO 4	Up to K 4	2	K1& K2	2	K2	2 (K3&K3)	1(K4)	
No. of Questions to be asked			4		3		4	3	14
No. of Questions to be answered			4		3		2	2	10
Marks for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

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 inferences with evidences

BLUE PRINT FOR EXTERNAL

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl. 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	K1& K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K3	2	K1& K2	1	K1	2 (K2&K2)	1(K3)
3	CLO 3	Up to K3	2	K1& K2	1	K2	2 (K3&K3)	1(K3)
4	CLO 4	Up to K4	2	K1& K2	1	K2	2 (K4&K4)	1(K4)
5	CLO 5	Up to K4	2	K1& K2	1	K2	2 (K3&K3)	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

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 inferences 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	5	2	10	--	**17**	14.16	**42%**
K2	5	8	10	10	**33**	27.5	
K3	-	-	20	30	**50**	41.67	**42%**
K4	-	-	10	10	**20**	16.67	**16%**
Total Marks	10	10	50	50	**120**	100.00	**100%**