

DEPARTMENT OF BOTANY				CLASS: II B.Sc. Botany				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
IV	Major core 6	20U4BMC6	Cell Biology and Biochemistry	5	5	25	75	100

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

Course objectives: This course will enable the students to

1. gain an overview of cells, cell types, various cell organelles and their structure, chemical composition and functions,
2. understand and appreciate the structure, organization, functionalities and importance of nucleus and chromosomes and their roles in cellular activities,
3. examine the features of basic chemical bonds and the energy associated with them and
4. understand the structure, functions and the importance of various biomolecules.

UNIT	CONTENT	CLO	K LEVEL	HOURS
I	Ultra Structure of Cell: Cell and cell doctrine. Prokaryotic and Eukaryotic cells. Differences between pro and eukaryotic cells. Ultra-structure of a plant cell. Plant cell envelopes - Ultra structure, chemical composition and the functions of cell wall and cell membranes including plasma membrane (Fluid Mosaic Model).	1	Up to K4	15
II	Cell organelles: Structure, chemical composition and functions of vacuole, golgi complex, endoplasmic reticulum, chloroplast, mitochondrion, ribosomes and microbodies (peroxisome and glyoxisome). Endosymbiosis theory. Extra nuclear genome - mitochondrial DNA and plastid DNA, plasmids.	2	Up to K4	15
III	Nucleus and Chromosomes: Structure, chemical composition and functions of nucleus. Chromosomes: morphology, organization of DNA in a chromosome (nucleosome model), euchromatin and heterochromatin, giant - polytene and lambrush. Cell inclusions (Cystolith and Raphides). Cell cycle, Cell divisions (mitosis and meiosis) and their significance.	3	Up to K4	15
IV	Basic concepts – atoms; chemical bonds – ionic, hydrogen, covalent; structure and properties of water. pH and Buffer. Bio molecules – structure, classification and properties of carbohydrates, monosaccharides - glucose, disaccharides – sucrose, polysaccharides – starch.	4	Up to K4	15
V	Biomolecules: Protein - Primary, secondary, Tertiary and Quaternary structure and Properties. Lipids – Classification and Properties, Structure of fatty acid – Simple (fats and oils), Compound (phospholipids) and Derived (cholesterol). Enzymes - Structure, Properties, Nomenclature and classification, Mechanism of Enzyme action (Induced Fit Model), Factors affecting enzyme action.	5	Up to K4	15

Books for Study

1. Sharma, A. K. and A. Sharma. (1999). Plant Chromosomes: Analysis, Manipulation and Engineering. Harward Academic Publishers, Australia.
2. Shukla, R.S. and Chandel, P.S (2007). Cytogenetics, Evolution, Biostatistics and Plant Breeding. S. Chand & Company Ltd., New Delhi.
3. Rastogi, S.C. (2015) Cell Biology, 3rd Edition, New Age International (P) Limited Publishers, New Delhi.
4. Jain J.L 1999 Fundamentals of Biochemistry S. Chand & co Ltd. New Delhi.
5. Verma P.S. and Agarwal V.K. (2016) Cell Biology (Cytology, Biomolecules, Molecular Biology), Paperback, S. Chand and Company Ltd.
6. Kumar P. and Mina U. (2018) Life Sciences: Fundamentals and Practice, Part-I, 6th Edn., Pathfinder Publication.

Books for Reference

1. Cooper G.M. (2019) The Cell – A Molecular Approach, 8th Edn., Sinauer Associates Inc., Oxford University Press.
2. Hardin J. and Bertoni G. (2017) Becker's World of the Cell. 9th Edn (Global Edition). Pearson Education Ltd.
3. Karp G., Iwasa J. and Masall W. (2015) Karp's Cell and Molecular Biology – Concepts and Experiments. 8th Edn. John Wiley and Sons.
4. Urry L.A. Cain M.L., Wasserman S.A., Minorsky P.V., Jackson R.B. and Reece J.B. (2014) Campbell Biology in Focus. Pearson Education.
5. Albert B., Hopkin K., Johnson A.D., Morgan D., Raff M., Roberts K. and Walter P. (2018) Essential Cell Biology 5th Edn.,(paper back) W.W. Norton & Company p.864.

Web Resources

1. <https://www.ncbi.nlm.nih.gov/books>
2. <https://www.khanacademy.org/science/biology/cellular-molecular-biology>
3. https://onlinecourses.swayam2.ac.in/cec20_ma14/preview
4. <https://micro.magnet.fsu.edu>
5. <https://cellbiology.med.unsw.edu.au>
6. <https://www.youtube.com/watch?v=bYpPMzzyZZ4>

Rationale for Nature of the Course

The students acquire a comprehensive theoretical knowledge in the field of cell biology and biochemistry.

Activities having direct bearing on Skill development / Employability / Entrepreneurship

The course will help the students to develop their knowledge on the nuances of cell systems and the micro and macro biomolecules, thereby to better understand the basics of research in cell systems.

Pedagogy

Chalk and Talk, PPT, Seminar, Discussion, Quiz, Virtual Labs, Google Classroom Discussion and CANVAS (Learning Management System).

Course Designer: Dr. S. Gnaana Saraswathi, Assistant Professor

Course Learning Outcomes: On the successful completion of the course the students will be able to

CLOs	CLO Statement	Knowledge level
CLO-1	Describe the cell and cell theory, ultra-structure of pro and eukaryotic cells, plant cell and its organelles	Up to K4
CLO-2	Analyse, relate and compare the extra nuclear genome and their significance	Up to K4
CLO-3	Explain and Justify the cell cycle, cell divisions and significance	Up to K4
CLO-4	Outline, explain, compare and differentiate the structure of an atom, and chemical bonds	Up to K4
CLO-5	Identify, describe and differentiate the structure, properties and biological significance of biomolecules namely carbohydrates, proteins and lipids. Discuss and organise their thought on the enzymes, their importance and enzyme action.	Up to K4

Mapping Programme Specific Outcomes with Course Learning Outcomes:

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8	PSO-9
CLO-1	3	3	3	3	2	2	2	3	3
CLO-2	3	3	3	3	2	3	3	2	3
CLO-3	1	2	3	3	3	3	3	2	3
CLO-4	1	1	2	1	1	2	1	1	1
CLO-5	3	3	3	3	3	3	3	3	3

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

Mapping Programme Outcomes with Course Learning Outcomes:

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

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

Lecture Schedule

Sl. No.	Description	Staff Name	Hours	Mode
I	a) Introduction to cell biology, cell and cell doctrine	-	2	Discussion
	b) Pro and eukaryotic cells and differences	-	3	Black board
	c) Plant cell structure	-	2	PowerPoint
	d) Cell wall -structure, composition and functions	-	3	Assignment
	e) Cell membrane - overview	-	1	PowerPoint
	f) Plasma membrane – structure, Fluid mosaic model.	-	2	PowerPoint & videos
	g) Chemical composition and functions	-	2	LMS
II	a) Structure, chemical composition and functions of	-	1	Assignment
	b) Vacuole	-	1	Video(s) clips
	c) Golgi complex	-	1	PowerPoint
	d) Endoplasmic reticulum	-	1	Video-clips
	e) Chloroplast	-	2	Black board
	f) Mitochondrion	-	2	PowerPoint & videos
	g) Ribosomes	-	1	PowerPoint
	h) Peroxisomes	-	1	PowerPoint
	i) Glyoxysomes	-	1	LMS
	j) Endosymbiosis theory	-	1	Videos
	k) Mitochondrial DNA	-	1	PowerPoint
	l) Chloroplast DNA	-	1	Discussion
	m) Plasmid DNA	-	1	Discussion Assignment
III	a) Structure, chemical composition and functions of Nucleus	-	7	Black board PowerPoint
	b) Chromosome morphology and organisation	-	2	Discussion
	c) Cell inclusions	-	1	PowerPoint & videos
	d) Cell cycle	-	2	PowerPoint & videos
	e) Mitosis	-	2	LMS
	f) Meiosis	-	1	Discussion
IV	a) Basic concepts and bonds	-	3	Discussion
	b) Structure and properties of water	-	3	Discussion
	c) pH and Buffers	-	2	PowerPoint
	d) Carbohydrates, structure and classification	-	2	Black board
	e) Mono, di and poly saccharides	-	5	Quiz
V	a) Proteins	-	5	Black board
	b) Lipids	-	5	PowerPoint
	c) Enzymes	-	5	Assignment
Total			75	

Blue Print – Model for External Examination

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

Sl. No	CLOs	K- Level	Section – A		Section – B		Section C (Either/ Choice)	Section D (Open Choice)
			MCQs		Short Answer			
			No. of Questions	K – Level	No. of Questions	K – Level		
1	CLO 1	Up to K 4	2	K1 & K2	1	K1	2(K1&K1)	1 (K2)
2	CLO 2	Up to K 4	2	K1 & K2	1	K1	2(K2&K2)	1 (K3)
3	CLO 3	Up to K 4	2	K1 & K2	1	K2	2(K3&K3)	1 (K3)
4	CLO 4	Up to K 4	2	K1 & K2	1	K2	2(K4&K4)	1 (K4)
5	CLO 5	Up to K 4	2	K1 & K2	1	K2	2(K3&K3)	1 (K3)
No. of Question to be asked			10		5		10	5
No. of Question to be answered			10		5		5	3
Mark 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 fact 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	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%

Blue Print – Model for Internal Examination
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section – A		Section – B		Section C (Either/ Choice)	Section D (Open Choice)	Total
			MCQs		Short Answer				
			No. of Questions	K – Level	No. of Questions	K - Level			
1	CLO x	Up to K 4	2	K1&K2	2	K1& K2	2(K2&K2)	1 (K2/K3)	
2	CLO y	Up to K 4	2	K1&K2	1	K2	2(K3&K3)	2 (K3&K4)	
No. of Question to be asked			4		3		4	3	14
No. of Question to be answered			4		2		2	2	10
Mark 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 fact 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	2	2		-	4	6.67	50
K2	2	4	10	10	26	43.33	
K3	-	-	10	10	20	33.33	33
K4	-	-		10	10	16.67	17
Total Marks	4	6	20	30	60	100.00	100%