ATMIYA UNIVERSITY
Faculty of Science
Department of Biotechnology

B. Sc. BIOTECHNOLOGY

SYLLABUS

For the students admitted from A.Y. 2023-2024 & onwards

Department: **Biotechnology** Programme: **B.Sc. Biotechnology**

Semester – I		
Course Code	**Course Title (F)**	**Credits**
23UGBT101	Core 1: Cell Biology	4 Credits

Course Description:

This course gives emphasis to a basic understanding of cell and its organization. The focus of this course is the study of the structure and function of the prokaryotic and eukaryotic cells. This course also gives brief introduction of cell-cell interaction. It also covers important cellular processes such as cell cycle, cell cycle regulation, cell locomotion, etc. Apart from fundamental concept course also deals with some advanced aspects of cells such as cancer cell biology and stem cell Biology.

Course Purpose:

The aim of the course is to provide basic knowledge about the structure and function of cells and cellular components. It is designed in such a way that students will be able to understand the structures and purposes of the basic components of prokaryotic and eukaryotic cells, especially membranes, organelles, and their interactions, as well as cell interactions. The course covers fundamental concepts and some advanced concepts of cell biology. The course will provide a deep insight into one of the basic units of the living system.

Course Outcomes: Upon completion of this course, the learner will be able to

CO No.	**CO Statement**	**Blooms taxonomy Level (K_1 to K_6)**

CO_1	Understand basic concept of cell and recognize the different levels of biological organization from molecules to organism.	K1, K2
CO_2	Illustrate the cells organelles and their functions	K2
CO_3	Understanding the basics of cell-cell interactions.	K2
CO_4	Explore the fundamental mechanisms of cell cycle & its regulation along with the mitotic & meiotic cell division.	K2, K3
CO_5	Develop the understanding the role and mechanisms of different cytoskeletons, and cell locomotion. Discussing the application of cell biology and stem cells.	K3

Course Content	**Hours**
Module-I: History of Cytology and Introduction to Cell	**10 hrs**
● Concept of Life, History of Cell Biology, and Cell Theory ● Origin and Evolution of Cell ● Cell Structure (Prokaryotes & Eukaryotes) and Cell Organization ● Chemical Composition of Cell ● Comparison of microbial, plant, and animal cells	
Module - II: Cell Organelles	**10 hrs**
● Cell Wall and Plasma Membrane, Transport ● Mitochondria, Chloroplasts ● Microbodies: Peroxisome and Glyoxysome ● GERL System: Endoplasmic Reticulum, Golgi Bodies, Lysosomes ● Nucleus & Ribosomes, Chromosome	
Module-III: Cell-Cell interaction	**10 hrs**
● Cell-Cell Interactions: Tight Junction (Structure and function), Anchoring Junction (Structure and function). ● Gap junction and Plasmodesmata. ● Extra-cellular matrix – Fibronectin, laminin. ● Cell adherence molecules – Cadherines, Selectin, Immunoglobulin superfamily, Integrins. ● Brief of Signaling molecule (Animal and Plant Hormone, Eicosanoids, Nitric oxide), Types of Cells Signaling: Endocrine, Paracrine, Autocrine, Contact dependent.	
Module - IV: Cell Cycle and Cell division	**9 hrs**
● Introduction of cell cycle	

● Cell cycle checkpoint ● Brief of cell cycle regulation ● Mitosis: Stages of Mitotic division ● Meiosis: Stages of Meiosis I and II	
Module - V: Advance Studies in Cell Biology	**9 hrs**
● Cytoskeleton: Structure and organization of Microtubules, ● Microfilaments, and Intermediate filaments. ● Cell Locomotion: Amoeboid, Flagella, Cilia, Cytoplasmic Streaming. ● Basics of Cancer Biology, Traits of Cancer. ● Basics of Stem Cells. Feature and types of stem cells.	

Textbooks:

1. Verma P.S. and Agarwal V.K. (2016) *Cell Biology (Cytology, Biomolecules, Molecular Biology)*, Paperback, S. Chand and Company Ltd.
2. Karp, G. (2004). *Cell and Molecular Biology: Concepts and Experiments 4th Edition with Study*. John Wiley & Sons.

Reference books:

1. Pollard, T. D., Earnshaw, W. C., & Lippincott-Schwartz, J. (2007). *Cell Biology*. Elsevier Health Sciences.
2. Hardin, J., Bertoni, G., Kleinsmith, L. J., & Becker, W. M. (2012). *The world of the cell Fifth edition*. The Benjamin/Cumming Publishing Company.
3. Cooper, G. M., & Hausman, R. E. (2016). *The cell: A molecular approach*. Washington, D.C: ASM Press.

Pedagogic tools:

- Chalk and Board
- PowerPoint presentation
- Scientific Games (Online / Offline)
- Competitions
- Quiz
- Model making
- Live demonstrations
- Seminar
- Videos

Methods of Assessment & Tools:

Components of CIA: 30 marks

Sr. No.	Component	Content	Duration (if any)	Marks	Sub Total
A	Test 1	1st 2 units	$1^{1/2}$ hours	5 (Set for 30)	20
	Test 2	All 5 units	3 hours	15 (Set for 70)	
B	Assignments			5	5
	Class Activity			5	5
				Grand Total	**30**
Assignment		● Cell structure drawings ● Presentation/ Team Teaching ● Model making and Exhibition ● Student-generated handbook, etc.			
Class Activity		● One-minute paper ● Situation-based question ● Quiz: Online/ Offline, etc.			

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Department: **Biotechnology** Programme: **B.Sc. Biotechnology**

Semester – I		
Course Code	**Course Title**	**Credit**
23UGBT102	Cell Biology Practical	2 Credit

Course Purpose:
This practical course enables students to explore the microscopic world of cells. It provides basic practical skills for acquiring and demonstrating competency in microscope operation, staining and sectioning techniques, and the study of eukaryotic cells. Additionally, the course helps students operate general laboratory equipment and instruments used in scientific research laboratories. Furthermore, the course aims to teach students about the different stages of somatic and gametic cell division.

Course Outcomes: Upon completion of this course, the learner will be able to

CO No.	**CO Statement**	**Blooms taxonomy Level (K_1 to K_6)**
CO1	Understanding the essential laboratory equipment.	K1, K2
CO2	Development of analytical skills for the preparation of solutions.	K1
CO3	Get awareness of the physiological processes of cells e.g., cell divisions, etc.	K1, K2
CO4	Isolate cell organelles including mitochondria and chloroplast from the eukaryotic cell	K2
CO5	Understanding the arrangements of different cells and the structures of plants & animals.	K2
CO6	Adopt the attitude, skills, and values for self-directed lifelong learning	K2
CO7	Develop skills of quality control practices applicable in their scientific or industrial career.	K2

List of Experiments:	
● Introduction to the laboratory environment and laboratory equipment. ● Preparation of Solutions. ● Study of various stages of Mitosis from Onion root tip cells. ● Study of different stages of Meiosis from flower buds. ● Cell Counting and viability. ● Isolation and Staining of Chloroplast. ● Isolation and Staining of Mitochondria. ● Microscopic study of germinating seeds. ● Cytogenetic study of animal cells (Demonstration) ● Cytology and Histology of various Organs (Permanent slides observation) (Demonstration)	

Reference Books

1. Davey, J. (2003). Essential Cell Biology: A Practical Approach (Vol. 2). Oxford University Press, USA.
2. Verma, A., Das, S., & Singh, A. (2014). Laboratory Manual for Biotechnology. S. Chand and Co. Pvt. Ltd, New Delhi. ISBN, 978-93.
3. Celis, J. E., Carter, N., Simons, K., Small, J. V., Hunter, T., & Shotton, D. (2005). Cell biology, four-volume set: a Laboratory Handbook. Academic Press
4. Celis, J. E. (1998). Cell biology: A Laboratory Handbook, Vol. 2. San Diego, CA: Academic Press.

Pedagogic tools:

- Chalk and Board
- Power point presentation
- Discussion
- Demonstration
- Hand on training
- Animated Video to explain principle and procedure
- Virtual labs to understand concepts

Methods of assessing the course outcomes

Components of CIA: 50 marks

Sr. No.	Component	Content	Duration (if any)	Marks	Sub Total
A	Test 1	70% Practical completion	4 hours	30	30
B	Record Book/ Laboratory Activity			05	05
C	Spotting			05	05
D	Viva-Voce			10	10
				Grand Total	**50**

Test 1	● Practical performance = 20 Marks ● Practical Theory = 10 Marks
Record Book/ Laboratory Activity	● Record book – 5 marks ● Laboratory Attendance – 5 marks
Spotting	● Spotting (Assignment after 70% practical completion – 10 marks
Viva-Voce	● Viva-Voce (Assessment after 70% practical completion) – 5 marks