

Bachelors with Microbiology as Major
3rd Semester

MBY322J: Microbiology: Cell Biology and Biochemistry

Credits: Theory=4, Practical=2

Course Objectives:

- This course has been designed to teach students about cell organization of eukaryotes, cell division, cell cycle and cell signaling
- This course will provide students comprehensive information about the structural and functional diversity of biomolecules in the living system

Credit I: Cell Wall, Membrane Structure and Nucleus

- 1.1. Eukaryotic cell wall, Extracellular matrix, Cell-Cell Interactions
- 1.2. Plasma membrane: Structure and transport of small molecules
- 1.3. Structure of nucleus (nuclear envelope and nucleolus)
- 1.4. Chromatin – Structural organization
- 1.5. Cell division and cell cycle

Credit II: Cell Signaling

- 2.1. Signal transduction (Elementary Idea)
- 2.2. Mechanism of signal transduction (Concept)
- 2.3. Signaling molecules and their receptors
- 2.4. Function of cell surface receptors
- 2.5. Pathways of intracellular receptors – Cyclic AMP pathway and cyclic GMP pathway

Credit III: Carbohydrates and Lipids

- 3.1. Definition and classification of carbohydrates
- 3.2. Structure of monosaccharides and disaccharides
- 3.3. Stereoisomerism of monosaccharides
- 3.4. Definition, nature and classification of lipids
- 3.5. Fatty acids and their classification

Credit IV: Proteins and Enzymes

- 4.1. Amino acids as building blocks of proteins
- 4.2. Structure of proteins: Secondary, tertiary and quaternary
- 4.3. Over view and classification of enzymes
- 4.4. Basic theories of enzyme catalysis
- 4.5. Concept of enzyme kinetics

Credit V: Practical I

- 5.1. To perform differential isolation of cell organelles by differential centrifugation
- 5.2. Demonstration of cell cycle by slides
- 5.3. Study a representative fungal cell by microscopy
- 5.4. Demonstration of karyotyping by slides
- 5.5. Temporary mounting of meiotic cell cycle stages from grass hopper testis

Credit VI: Practical II

- 6.1. To perform preparation qualitative tests for carbohydrates
- 6.2. To perform preparation qualitative tests for reducing and non-reducing sugars
- 6.3. To perform preparation qualitative tests for lipids and proteins
- 6.4. Study of protein secondary and tertiary structures with the help of models
- 6.5. Study of enzyme kinetics – calculation of V_{max} , K_m , K_{cat} values

Note: Those experiments which can't be performed in laboratory, should be conducted via Virtual lab

Learning outcome:

- Students will get knowledge about eukaryotic cell structure, cell cycle, cell division and cell signaling
- They will acquire knowledge about the significance of various bio-molecules in cell structure and physiology

Recommended Books

1. Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger, Anthony Bretscher, Hidde Ploegh, Kelsey C. Martin, Michael Yaffe, Angelika Amon (2021) Molecular Cell Biology, Ninth Edition, W.H Freeman and Company.
2. Alberts Bruce, Alexander Johnson, Julian Lewis, David Morgan, Martin Raff, Keith Roberts, Peter Walter (2015) Molecular biology of the Cell. Garland publishing Inc.
3. David L. Nelson, Albert L. Lehninger, Michael M. Cox (2021) Lehninger Principles of Biochemistry. WH Freeman and company, 8th Edition.
4. Biochemistry (Seventh Edition) JM Berg and JL Tymoczko and L. Stryer (international Edition) W.H. Freeman & Company (2003)
5. Practical Biochemistry Principle and Technology, K. Wilson and John Walker, Cambridge University Press (2004)
6. Andreas Hofmann, John M. Walker, Keith Wilson, Samuel Clokie (2018) Principles and Techniques of Biochemistry and Molecular Biology. Andreas Hofmann, John M. Walker, Keith Wilson, Samuel Clokie, 8th Edition.