Syllabus template

Semester: 6	
Course: Minor 2	
Paper Title: Biophysical Chemistry	
Paper code: B3BT230612T / B3BT230612P	**Credits: 4 (3 Th + 1 Pr)**
Hours/week: 3 + 2	
Category: Core/MDC/SEC/VAC: Minor	
Theory / Practical / Composite: Composite	
No of Modules: 1	

Course Overview:

1. Understanding the application of buffer solution and its importance in biological system.
2. Acquiring a knowledge of basic thermodynamics and its application to biological systems.
3. Gaining a concept of spectroscopy and its application.
4. Identifying different chromatographic techniques to separate biomolecules.
5. Developing a concept of biophysical techniques.

Course Outcome: Theory

1. Remember ionization of water, pH scale, first and second law of thermodynamics, concept of entropy, enthalpy and free energy, Absorption and emission spectroscopy, different chromatographic techniques (Paper chromatography, Thin layer chromatography, Size exclusion, Ion exchange and Affinity chromatography).

2. Apply principles of buffer solution in living system, first and second law of thermodynamics in biological system, Lambert-Beer Law in various experiments, principles of chromatography to separate biomolecules, principles of various spectroscopy (UV-Vis, Fluorescence, Circular dichroism, Infrared) in Biotechnology.

3. Analyze various calculation of pH, hydrolysis of salts, thermodynamics of protein folding/stability, principles of various spectroscopy and chromatography and its application.

4. Understand acid-base titration, reversible and irreversible processes, various spectroscopy and chromatography.

5. Evaluate buffer capacity, Gibbs-Helmholtz equation chemical potential and equilibrium constant,
various spectroscopic and chromatographic techniques which have useful applications in Biotechnology.

6. Create a concept of buffer solution and its importance in biological system, a comprehensive overview of thermodynamics and its application in Biology, an overall knowledge of various spectroscopic and chromatographic techniques in studying biological molecules, a basic knowledge of HPLC and FPLC, Gel Electrophoresis and its application in Biotechnology.

Course Outcome: Practical

1. Prepare normal/molar solutions and understand the importance of standard solutions.
2. Analyze the difference between strong and weak acid by titration against NaOH.
3. Estimate amino nitrogen in amino acid which plays significant role in biological systems.
4. Measure pH of buffer solutions and understand the importance of buffering action in biological systems.
5. Apply chromatographic techniques such as paper chromatography and thin-layer chromatography (TLC) to separate and identify amino acids and lipids.
6. Evaluate estimation of protein by Biuret method.
7. Provide an overview of various technical methods which have useful applications in Biotechnology.

SYLLABUS				
UNIT/Module	**CONTENT**	**HOURS or NUMBER OF CLASSES**	**CO Mapping**	**COGNITIVE LEVEL**
	Unit-I: Buffer solution and its application: Ionization of water, pH scale, Calculation of pH, Hydrolysis of salts, Buffer solutions, pH of buffer solutions, Buffer capacity, Buffer solution in biological systems, Acid-base titration. Unit-II: Thermodynamics and its application in Biology: First and second law of thermodynamics, Concept of entropy, enthalpy and free energy, Criteria for reversible and irreversible processes, Gibbs-Helmholtz equation, Applications of first and second law of thermodynamics in living cells, Chemical potential and equilibrium constant, Thermodynamics of protein folding/stability. Unit-III: Spectroscopic Techniques: Absorption and emission spectroscopy, Lambert-Beer Law. UV-Vis spectroscopy, Fluorescence spectroscopy, Circular dichroism (CD), Infrared (IR) spectroscopy and their applications in studying biological molecules. Unit-IV: Chromatographic Techniques: Principle of chromatography. Paper chromatography, Thin layer chromatography, Size exclusion, Ion exchange and Affinity chromatography, HPLC and FPLC, Gel Electrophoresis.	3 classes per week	CO1-CO6	K1-K6
Practical	1. Preparation of normal/molar solutions 2. Titration of strong acid against NaOH using phenolphthalein indicator	2 classes per week		

	3. Titration of weak acid against NaOH using phenolphthalein indicator 4. Estimation of total quantity of amino nitrogen 5. Preparation of phosphate buffer 6. Paper chromatography 7. Thin layer chromatography 8. Estimation of protein by Biuret method			

Text Books

1. Upadhyay, Upadhyay and Nath, Biophysical Chemistry: Principles and Techniques.

2. P. C. Rakshit, Physical Chemistry, Sarat Book House, Revised & enlarged 7th edition, 2014.

3. C. N. Banwell & E. M. McCash, Fundamentals of Molecular Spectroscopy, 4th Edition.

4. William Kemp, Organic Spectroscopy.

5. David T Plummer, An Introduction to Practical Biochemistry.

Evaluation:
Theory: 60 marks
CIA –10, Assignment – 02, Attendance – 03, Semester Exam – 45
Practical: 40 marks
CIA –30, Attendance – 02, Semester Exam – 08

Paper Structure for Theory Semester Exam:
1. Compulsory question of 5 marks
2. Questions of 10 marks each (Any 4 out of 6 questions) [No subpart will be less than 1 mark, not more than 5 marks]

Course outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive levels
	Module 1	
CO1	Define the various aspects of classification of organisms by cell structure, of the cell, cell membrane and subcellular organelles	K1
CO2	Describe organization and components of the biological membranes and structure and function of subcellular organelles (for e.g., lysosomes, ribosomes, mitochondria and nucleus)	K2
CO3	Apply the concept of Fluid Mosaic Model, cell membrane permeability, cell fractionation and illustrate roles of subcellular organelles	K3
CO4	Associate the concepts of compartmentalization of eukaryotic cells, membrane as a dynamic entity and structure, function and dysfunction of subcellular organelles with cellular function	K4
CO5	Compare and contrast various aspects of the cell, cell membrane and subcellular organelles	K5
CO6	Create a comprehensive overview of the basic principles of cell biology	K6
	Module 2	

CO1	Outline the various aspects of cytoskeleton and cell motility, extracellular matrix, cell division, cancer and apoptosis	K1
CO2	Discuss the structure and function of cytoskeletal elements and the extracellular matrix and explain the processes of cell division, cancer and apoptosis and their significance	K2
CO3	Illustrate the roles of microtubules, microfilaments, intermediate filaments, extracellular matrix proteins and membrane receptors in cellular functions, and determine the processes of mitosis and meiosis, the concept of cancer as dysregulation of cell division and pathways of apoptosis	K3
CO4	Use analysis to differentiate between the structural and functional roles of microtubules, microfilaments, intermediate filaments, extracellular matrix proteins, cell-cell junctions, and associate the agents promoting carcinogenesis, differences in characteristics of cancer and normal cells and apoptotic pathways with the processes of cancer and apoptosis	K4
CO5	Critically evaluate various aspects of cytoskeleton and cell motility, extracellular matrix, cell division, cancer and apoptosis	K5
CO6	Develop a comprehensive overview of the basic principles of cell biology	K6