

## SYLLABUS OF BIOCHEMISTRY :

### CBCS PATTERN FOR SEMISTER III AND SEMISTER IV

**FROM ACADEMIC YEAR 2012- 2013**

Second Year	Semester III		Semester IV	
<b>4 Credits</b>	<i>201:Biophysics &amp; Instrumentation</i>		<i>204:Advance Techniques</i>	
	Unit 1:	Water, pH, Buffers, pH meter	Unit 1:	Microscopy
	Unit 2:	Adsorption, Viscosity, S.T, osmosis, Donnan	Unit 2:	Centrifugation & cell fractionation
	Unit 3:	Chromatography & Electrophoresis	Unit 3:	Radioisotopes & measurements
	Unit 4:	Colorimeter, Spectrophotometer. Spectrofluorimeter	Unit 4:	Analysis of Biochemical data (Biostatistics)
	<i>202:Cell biology &amp;Physiology</i>		<i>205: Physiology of various systems</i>	
<b>4 Credits</b>	Unit 1:	Cell biology	Unit 1:	Respiratory system
	Unit 2:	Tissues (epithelial, connective, muscle, nerve)	Unit 2:	Digestive system
	Unit 3:	Physiological Chemistry.	Unit 3:	Excretory system
	Unit 4:	Circulatory system	Unit 4:	Blood
<b>2.5 credits</b>	<i>203: Practical</i>		<i>206: Practical</i>	
<b>2 credits</b>	<i>Sub Elective: 201:</i>		<i>Sub Elective: 202:</i>	

## Semester III

### *201: Biophysics & Instrumentation*

*(4 credits)*

#### **Unit 1: Water, pH, Buffers, pH meter**

Properties of water, Water a biological solvent, Fitness of the aqueous environment for living organisms, self Ionization of water:  $K_w$  and  $pK_w$ .

Acid, base, ampholytes, pH, pOH, pKa, weak and strong acids, Physiological importance of pH.

Buffers, buffer action, buffer capacity, Henderson – Hasselbalch equation, its limitations and uses, laboratory use of buffers, physiological importance of buffers in body fluids and tissues.

Measurement of pH: indicators, pH meter, different types of electrodes, advantages and disadvantages of different electrodes, principle, working, application, factors affecting pH determination

#### **Unit 2: Biophysics**

Poiseuille's equation, unit of viscosity, relative viscosity and its determination, factors affecting viscosity, physiological importance.

Principle of adsorption, Orientation of molecules on surface, factors affecting adsorption, application of adsorption.

Gibbs – Thomson principle of surface tension and its relation to ST, surface energy, factors affecting surface tension, methods to determine ST, applications of ST.

Mechanism of osmotic pressure, Van't Hoff's laws of osmotic pressure, Measurement of osmotic pressure (Pfeffer's, Berkley's method etc), physiological importance of osmotic pressure, counter current distribution, distribution of solutes between two immiscible solvents.

Donnan membrane equilibrium and its relation to osmotic pressure, membrane hydrolysis, importance of DM equilibrium in tissue fluids.

### **Unit 3: Chromatography & Electrophoresis**

Principle, technique, applications, advantages and disadvantages of:

Ion exchange chromatography, Gel filtration chromatography, Affinity chromatography, Adsorption chromatography, Thin Layer Chromatography, Reverse phase chromatography, hydrophobic interaction chromatography, HPLC, GLC.

Principle, technique, factors affecting, detection, applications, advantages and disadvantages of:

Gel electrophoresis (PAGE, agarose, cellulose acetate, starch gel)

Detection methods (Staining, Densitometric), Isoelectrofocusing

2-D gel electrophoresis.

### **Unit 4: Colorimeter, Spectrophotometer. Spectrofluorometer**

Beer-Lamberts Law, principle and working of single cell colorimeter, and double cell colorimeter.

Monochromators: filters, diffraction grating, prisms.

Principle and working of spectrophotometer and spectrofluorimeter.

Applications, merits and demerits of: colorimeter, spectrophotometer and spectrofluorimeter.

#### **Ref:**

1. Berg JM, and Tymoczko TJ, Stryer L,: Biochemistry (6<sup>th</sup> ed)
2. Daniel, C Harris: Quantitative Chemical Analysis
3. David Freifelder: Physical biochemistry (2<sup>nd</sup> ed) WH Freeman, USA)
4. Donald Voet and Voet J: Biochemistry (4<sup>th</sup> ed) 2011
5. Ghatak KL: Techniques and methods in Biology. PHI learning Pvt Ltd. 2011
6. Nelson DL and Cox MM: Lehninger's Principles of Biochemistry (5<sup>th</sup> ed) 2008
7. Oser: Hawks Physiological Chemistry (4<sup>th</sup> ed) 1965.
8. Upadhyay and Nath: Biophysical chemistry: Principles and Techniques (3<sup>rd</sup> ed)
9. Van Holde KE: Physical Biochemistry. Prentice Hall, NJ.
10. Vogel AI: A text book of quantitative inorganic analysis (3<sup>rd</sup> ed), 1975.
11. West and Todd: Text book of biochemistry ((4<sup>th</sup> ed) 1970
12. Wharton and McCarty: Experiments and methods in Biochemistry
13. Willard and Merrit: Instrumental methods of analysis (4<sup>th</sup> ed) 1971.
14. Wilson K and Walker J: Principles and Techniques of Biochemistry and Molecular Biology (6<sup>th</sup> ed) 2006. Cambridge University Press.

# Semester III

## 202: Cell biology & Physiology

(4 credits)

### Unit 1: Cell Biology

Structure, composition and functions of plant and animal cell organelles:  
Cell Wall, Plasma Membrane, Endoplasmic Reticulum, Chloroplasts,  
Mitochondria, Lysosomes, Golgi Bodies, Ribosomes, Nucleus, Peroxisomes, Cytosol,  
Glyoxysomes.

Localization of enzymes in organelles, comparison of prokaryotic and eukaryotic cells  
Cell fractionation methods to study cell organelles.

### Unit 2: Tissues (epithelial, connective, muscle, nerve)

Epithelial tissue, structure of sarcomere, proteins present in muscle, muscle contraction,  
sliding filament theory, regulation and role of hormones and calcium in muscle contraction

Structure and functions of nerve and glial cells, action potential and nerve conduction,  
Chemical and electrical synapses, reflex action, neurotransmitters: eg. Acetyl Choline

Structure of bone, inorganic and organic phase, (collagen), bone cells, bone mineralization,  
factors affecting bone remodeling, bone deformities .

### Unit 3: Physiological Chemistry

Hormones: Introduction & Mechanism of hormone action (Gene activation, cAMP).  
Pancreatic (Insulin & Glucagon) & Thyroid Hormones.

Vitamins as Coenzymes (B complex, vitamin C)  
Structure of Vitamins & Coenzymes, Dietary Sources, Name of the deficiency diseases, and  
Role of the Coenzyme in enzyme catalyzed reaction with an example.

### Unit 4: Circulatory system

Structure and functions of heart, rhythmicity of heart, cardiac cycle, heart sounds, blood  
pressure, factors affecting blood pressure, heart rate, factors affecting heart rate, cardiac  
output, ECG, pulmonary and systemic circulation.

## Ref:

1. Best and Taylor: Physiological basis of Medical practice
2. Bhagavan NV: Medical Biochemistry (4<sup>th</sup> ed), Jones and Bartlett Publishers
3. Charterjee: Human Physiology Vol. 1 and 2.
4. Chatterjee and Shinde: Text book of Medical Biochemistry
5. Das AK: Human Physiology
6. Ganong WF: Review of Medical Physiology (12<sup>th</sup> ed). Lange Medical Publishers
7. Guyton AG and Hall JE: Text book of Medical Physiology (11<sup>th</sup> ed) Harcourt Asia.
8. Murray RK, Granner DK, Mayes PA and Rodwell, VW: Harper's Biochemistry (25<sup>th</sup> ed) 2000, Prentice Hall publishers.
9. Sherwood: Human Physiology (5<sup>th</sup> ed) 2004
10. Talwar PC: Text book of Biochemistry and Human Physiology
11. Tortora G and Grabowski SR: Principles of Anatomy and Physiology (10<sup>th</sup> ed) 2003. John Wiley and sons.

## **203: Practicals**

**(2.5 credits)**

**Duration: 3hr**

**Marks: 100**

**Total 60 hrs**

### **Experiments involving colorimeter**

1. Sugar estimation by Nelson Somogyi method
2. Estimation of cholesterol by Zlatki's method.
3. Protein estimation by Folin-Ciocalteau method
4. Estimation of Urea by DAMO method.
5. Estimation of Creatinine by alkaline picrate method.
6. Estimation of Uric acid by phosphotungstic method.
7. Estimation of Iron by 2,2 dipyridyl method
8. Estimation of Phosphorus by Fiske-Subbaroa method.

### **Experiments involving Biophysics & Instrumentation**

9. Electrophoresis of serum proteins(demonstration)
10. SDS-gel electrophoresis. (demonstration)
11. Paper chromatography for separation of simple sugars.
12. Paper chromatography for separation of amino acids.
13. Column chromatography for separation of plant pigments.
14. Thin layer chromatography for amino acids.
15. Viscosity measurement of olive oil.
16. pH measurements & numerical based on pH.
17. Preparation of buffer & numerical based on buffer.

### **Titration**

1. Estimation of sugar from Urine by Benedict's method.
2. Study tour to teach advance chromatography technique (HPLC, Ion Exchange and Gas Chromatography, Spectrophotometer, Fluorimeter And Ultracentrifuge. Etc)

### **Ref:**

1. Oser: Hawk's Physiological Chemistry (14<sup>th</sup> ed)
2. Plummer: An introduction to practical Biochemistry
3. Sheela Sharma: Experiments and Techniques, 2007.
4. Thomas and Schalkhammer: Analytical Biochemistry, 2002
5. Varlery H: Practical Clinical Biochemistry
6. Whatton and McCarty: Experimental methods in Biochemistry
7. Willard and Merrit: Instrumental methods of analysis.