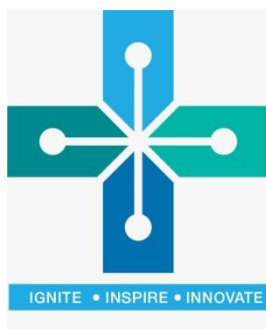


**St. PETER'S INSTITUTE OF HIGHER EDUCATION  
AND RESEARCH**

(Deemed to be University U/S 3 of the UGC Act, 1956)  
Avadi, Chennai – 600 054.



**M.Sc. (BIOCHEMISTRY) DEGREE  
PROGRAMME**

(I to IV SEMESTERS)

**REGULATIONS AND SYLLABI**

**REGULATIONS – 2016**

**(Effective from the Academic Year 2016-'17)**

# M.Sc. BIOCHEMISTRY DEGREE PROGRAMME

Regulations – 2016

(Effective from the Academic Year 2016-'2017)

- 1. Eligibility:** Candidates who passed B.Sc. Degree in Biotechnology, Biology, Botany, Zoology, Microbiology, Genetics, Biochemistry, Agriculture or B.E/ B.Tech (Biotech), B.V.Sc, MBBS, BDS, B.Pharm. from recognized Institute, or an examination accepted by the Institute as equivalent thereto are eligible for admission to M.Sc. Degree Programme in Biochemistry.
- 2. Duration:** Two years comprising 4 Semesters. Each semester has a minimum of 90 working days with a minimum of 5 hours a day.
- 3. Medium:** English is the medium of instruction and examinations.
- 4. Eligibility for the Award of Degree:** A candidate shall be eligible for the award of degree only if he/she has undergone the prescribed course of study in the University for a period of not less than two academic years (4 semesters), passed the examinations of all the four semesters prescribed carrying 80 credits and also fulfilled such conditions as have been prescribed thereof.
- 5. Choice Based Credit System:** Choice Based Credit System is followed with one credit equivalent to one hour for theory paper and two hours for a practical work per week in a cycle of 18 weeks (that is, one credit is equal to 18 hours for each theory paper and one credit is equal to 36 hours for a practical work in a semester in the Time Table. The total credit for the M.Sc. Degree Programme in Biochemistry (4 semesters) is 80 credits.
- 6. Weightage for a Continuous and End Assessment:** The weightage for Continuous Assessment (CA) and End Assessment (EA) is 25:75 unless the ratio is specifically mentioned in the Scheme of Examinations. The question paper is set for a minimum of 100 marks.
- 7. Course of Study and Scheme of Examinations:**

## I Semester

Code No.	Course Title		Credit	Marks		
				CA	EA	Total
<b>Theory</b>						
116PBYT01	<b>Core Sub:</b>	Biomolecules	4	25	75	100
116PBYT02		Biochemical Techniques	4	25	75	100
116PBYT03		Physiology and Cell Biology	4	25	75	100
116PBYT04	<b>Elective Paper – I: Microbiology</b>		4	25	75	100
<b>Total</b>			<b>16</b>	<b>100</b>	<b>300</b>	<b>400</b>

## II Semester

Code No.	Course Title		Credit	Marks		
				CA	EA	Total
<b>Theory</b>						
216PBYT01	<b>Core Sub:</b>	Enzymes and Enzyme Technology	4	25	75	100
216PBYT02		Intermediary Metabolism - I	4	25	75	100
216PBYT03		Intermediary Metabolism - II	4	25	75	100
216PBYP01		<b>Practical -I</b>	2	40	60	100
216PBYP02		<b>Practical -II</b>	2	40	60	100
216PBYT04		<b>Elective Paper – II:</b> Energy and drug metabolism		4	25	75
216PBYT05	<b>Extra Disciplinary – I:</b> Essential Biochemistry		4	25	75	100
<b>Total</b>			<b>24</b>	<b>205</b>	<b>495</b>	<b>700</b>

## III SEMESTER

Code No.	Course Title		Credit	Marks		
				CA	EA	Total
<b>Theory</b>						
316PBYT01	<b>Core Sub:</b>	Biotechnology	4	25	75	100
316PBYT02		Clinical Biochemistry - I	4	25	75	100
316PBYT03		Molecular Biology	4	25	75	100
316PBYT04	<b>Elective Paper – III:</b> Biostatistics		4	25	75	100
316PBYT05	<b>Extra Disciplinary – II:</b> Life Style – diseases Prevention		4	25	75	100
<b>Total</b>			<b>20</b>	<b>125</b>	<b>375</b>	<b>500</b>

## IV SEMESTER

Code No.	Course Title		Credit	Marks		
				CA	EA	Total
<b>Theory</b>						
416PBYT01	<b>Core Sub:</b>	Hormones	4	25	75	100
416PBYT02		Clinical Biochemistry - II	4	25	75	100
416PBYP01		<b>Practical - III</b>	2	40	60	100
416PBYP02		<b>Project and Viva</b>	2	40	60	100
416PBYT03	<b>Elective Paper – IV:</b> Signal transduction		4	25	75	100
416PBYT04	<b>Elective Paper – V :</b> Immunochemistry		4	25	75	100
<b>Total</b>			<b>20</b>	<b>180</b>	<b>420</b>	<b>600</b>

### List of Electives

Course Code	Course Title	Credits
<b>I Semester - Elective I</b>		
116PBYT04	Microbiology	4
<b>II Semester - Elective II</b>		
216PBYT04	Energy and drug metabolism	4
<b>III Semester - Elective -III</b>		
316PBYT04	Biostatistics	4
<b>IV Semester - Elective –IV &amp; V</b>		
416PBYT03	Signal transduction	4
416PBYT04	Immunochemistry	4

### List of Extradisciplinary

Course Code	Course Title	Credits
<b>II Semester Extra Disciplinary</b>		
216PBYT05	Essential Biochemistry	4
<b>III Semester</b>		
316PBYT05	Life Style – diseases Prevention	4

- 8. Passing Requirements:** The minimum pass mark (raw score) be 50% in End Assessment (EA) and 50% in Continuous Assessment (CA) and End Assessment (EA) put together. No minimum mark (raw score) in Continuous Assessment (CA) is prescribed unless it is specifically mentioned in the Scheme of Examinations.
- 9. Grading System:** Grading System on a 10 Point Scale is followed with 1 mark = 0.1 Grade point to successful candidates as given below.

**CONVERSION TABLE**

(1 mark = 0.1 Grade Point on a 10 Point Scale)

Range of Marks	Grade Point	Letter Grade	Classification
90 to 100	9.0 to 10.0	O	First Class
80 to 89	8.0 to 8.9	A	First Class
70 to 79	7.0 to 7.9	B	First Class
60 to 69	6.0 to 6.9	C	First Class
50 to 59	5.0 to 5.9	D	Second Class
0 to 49	0 to 4.9	<b>F</b>	<b>Reappearance</b>

**Procedure for Calculation**

Cumulative Grade Point Average (CGPA)	=	$\frac{\text{Sum of Weighted Grade Points}}{\text{Total Credits}}$
	=	$\frac{\sum (CA+EA) C}{\sum C}$
Where Weighted Grade Points in each Course	=	Grade Points (CA+EA) multiplied by Credits
	=	(CA+EA)C
Weighted Cumulative Percentage of Marks(WCPM)	=	CGPAx10

C- Credit,

CA-Continuous Assessment,

EA- End Assessment

**10. Effective Period of Operation for the Arrear Candidates :** Two Year grace period is provided for the candidates to complete the arrear examination, if any.

**11. National Academic Depository (NAD):** All the academic awards (Grade Sheets, Consolidated Grade Sheet, Provisional Certificate, Degree Certificate (Diploma) and Transfer Certificate) are lodged in a digital format in National Academic Depository organized by Ministry of Human Resource Development (MHRD) and University Grants Commission (UGC). NAD is a 24x7 online mode for making available academic awards and helps in validating its authenticity, safe storage and easy retrieval.

**Registrar**

**12. Syllabus**

## I Semester

### 116PBYT01 - BIOMOLECULES

#### UNIT-I

Carbohydrates- classification, structure, function and properties of monosaccharides (glucose, galactose, fructose), Disaccharides (lactose, cellobiose, sucrose, maltose). Homopolysaccharides (starch, glycogen, cellulose, inulin, dextrin, agar, pectin, dextran) Glycosaminoglycans- source, structure, functions of hyaluronic acid, chondroitin sulphates, heparin, keratan sulphate, proteoglycans. O- Linked and N-linked glycoproteins. Bacterial cell wall (peptidoglycans, teichoic acid) and plant cell wall carbohydrates.

#### UNIT-II

Lipids – classification of lipids, structure, properties and functions of fatty acids, triglycerides, phospholipids, glycolipids, sphingolipids and steroids. Eicosanoids- classification, structure and functions of prostaglandins, thromboxanes, leukotrienes. Lipoproteins – structure, function and mechanism of transport.

#### UNIT-III

Amino acids – classification, structure and properties of amino acids. Proteins – classification based on composition, structure and functions. Primary, secondary, super secondary and quaternary structure of proteins. Determination of amino acid sequence. Forces involved in stabilization of protein structure. Ramachandran plot. Folding of proteins. Structural characteristics of collagen and hemoglobin.

#### UNIT-IV

Nucleic acids – types and forms (A, B, C and Z) of DNA. Watson-Crick model- Primary, secondary and tertiary structures of DNA. Triple helix and quadruplex DNA Mitochondrial and chloroplast DNA. DNA supercoiling. Determination of nucleic acid sequences by Maxam Gilbert and Sanger's methods. Forces stabilizing nucleic acid 4 structure. Properties of DNA and RNA. C-value, C-value paradox, Cot curve. Structure and role of nucleotides in cellular communications. Major and minor classes of RNA and their structure.

#### UNIT-V

An overview of vitamins – source, structure and functions of water soluble and fat soluble vitamins – vitamin preparation, enrichment and fortification – overload and criteria of food sources. Antioxidants and oxidative stress. Phytochemicals – structure and functions of carotenoids, flavonoids, triterpenoids, polyphenols and lipoic acid.

#### Books Recommended:

1. David L.Nelson and Michael M.Cox (2012) Lehninger Principles of Biochemistry (6th ed) W.H. Freeman.
2. Voet.D & Voet. J.G (2010) Biochemistry , (4th ed), John Wiley & Sons, Inc.
3. Metzler D.E (2003). The chemical reactions of living cells (2nd ed), Academic Press.
4. Zubay G.L (1999) Biochemistry , (4th ed), Mc Grew-Hill.
5. Lubert Stryer (2010) Biochemistry,(7th ed), W.H.Freeman 6. Satyanarayan,U (2014) Biochemistry (4th ed), Arunabha Sen Books & Allied (P) Ltd, Kolkata.

## **116PBYT02 - BIOCHEMICAL TECHNIQUES**

### **UNIT-I**

General approaches to biochemical investigation. Organ and tissue slice technique, cell distribution and homogenization techniques, cell sorting, and cell counting, tissue culture techniques. Cryopreservation, and manometric techniques. Electrochemical techniques: Basic principles. The pH electrode. Ion-selective, gas- sensing and oxygen electrodes. Biosensors- principle and applications.

### **UNIT-II**

Basic principles of chromatography- adsorption and partition techniques. Chiral Chromatography and counter current Chromatography. Adsorption Chromatography - Hydroxy apatite chromatography and hydrophobic interaction Chromatography. Affinity chromatography.

Gas liquid chromatography- principle, instrumentation, column development, detectors-flame ionisation detectors (FID), nitrogen phosphorus detectors (NPD), electron capture detector (ECD), Flame photometric detector. Rapid scanning fourier transform infrared detector, Mass spectrometer detector and applications. Low pressure column chromatography - principle, instrumentation, column packing, detection, quantitation and column efficiency, High pressure liquid chromatography- principle, instrumentation, delivery pump, sample injection unit, column packing, development, detection and application. Reverse HPLC, capillary electro chromatography and perfusion chromatography

### **UNIT-III**

General principles of electrophoresis, supporting medium, factors affecting electrophoresis, Isoelectric focusing-principle, ampholyte, development of pH gradient and application. PAGE-gel casting-horizontal, vertical, slab gels, sample application, detection-staining using CBB, silver, fluorocrescent stains. SDS PAGE-principle and application in molecular weight determination principle of disc gel electrophoresis ,2D PAGE. Electrophoresis of nucleic acids-agarose gel electrophoresis of DNA, DNA sequencing gels, pulsed field gel electrophoresis-principle, apparatus, application. Field inversion gel electrophoresis. Electrophoresis of RNA, capillary electrophoresis- principle, instrumentation and calibration curve. Microchip electrophoresis. Immuno electrophoresis-qualitative, rocket, 2D electrophoresis.

### **UNIT-IV**

Basic laws of light absorption- principle, instrumentation and applications of UV-Visible, IR, ESR, NMR, Mass spectroscopy, Turbidimetry and Nephelometry. Luminometry (Luciferase system, chemiluminescence). Atomic flame and flameless spectrophotometry. Principle, working and uses of x-ray diffraction, optical rotatory dispersion (ORD) and circular dichroism.

### **UNIT-V**

Principle, working and applications of light microscope, dark field, phase contrast and fluorescent microscope. Electron microscope- Principle, instrumentation of TEM and SEM, Specimen preparation and applications-shadow casting, negative staining and freeze fracturing.

Nature of radioactivity-detection and measurement of radioactivity, methods based upon ionisation (GMcounter) and excitation (scintillation counter), autoradiography and applications of radioactive isotopes, Biological hazards of radiation and safety measures in handling radioactive isotopes.

### **Books Recommended**

1. Keith Wilson , John Walker (2010) Principles and Techniques of Biochemistry and Molecular Biology (7th ed) Cambridge University Press
2. David Sheehan (2009), Physical Biochemistry: Principles and Applications (2nd ed), Wiley-Blackwell
3. David M. Freifelder (1982) Physical Biochemistry: Applications to Biochemistry and Molecular Biology, W.H. Freeman
4. Rodney F. Boyer (2012), Biochemistry Laboratory: Modern Theory and techniques, (2nd ed), Prentice Hall
5. Kaloch Rajan (2011), Analytical techniques in Biochemistry and Molecular Biology, Springer
6. Segel I.H (1976) Biochemical Calculations (2nd ed), John Wiley and Sons
7. Robyt JF (2015) Biochemical techniques : Theory and Practice (1st ed), CBS Publishers & Distributors.

## 116PBYT03 - PHYSIOLOGY AND CELL BIOLOGY

### UNIT-I

Major classes of cell junctions- anchoring, tight and gap junctions. Major families of cell adhesion molecules (CAMs)- cadherins, integrins. Types of tissues. Epithelium- organization and types. The basement membrane. Connective tissue and extracellular matrix- proteoglycans, glycoproteins and glycosaminoglycans.

### UNIT-II

Composition of membranes- the lipid bilayer, peripheral and integral proteins. The fluid mosaic model. Brief account of membrane rafts. Endocytosis and exocytosis. Membrane transport: types. Diffusion- passive and facilitated. General classes of transport systems-uniport, symport, antiport. Active transport- primary and secondary. The P-type ATPases (Na<sup>+</sup>K<sup>+</sup>-ATPase), F-type ATPases (ATP synthases), ABC transporters, ionophores, aquaporins, ion channels (ligand-gated and voltage-gated).

### UNIT-III

Digestive system- structure and functions of different components of digestive system, digestion and absorption of carbohydrates, lipids and proteins, role of bile salts in digestion and absorption, mechanism of HCl formation in stomach, role of various enzymes and hormones involved in digestive system.

Composition of blood, lymph and CSF. Blood cells - WBC, RBC and energy metabolism of RBC, Blood clotting mechanism and blood groups- ABO and Rhesus system.

### UNIT- IV

Respiratory system-Gaseous transport and acid-base homeostasis. Mechanism of the movement of O<sub>2</sub> and CO<sub>2</sub> through lungs, arterial and venous circulation. Bohr effect, oxygen and carbon dioxide binding hemoglobin. pH maintenance by cellular and intracellular proteins. Phosphate and bicarbonate buffers, Metabolic acidosis and alkalosis. Respiratory acidosis and alkalosis. Regulation of fluid and electrolyte balance.

### UNIT-V

Sensory transduction, Nerve impulse transmission- nerve cells, synapses, reflex arc structure, resting membrane potential, Nernst equation, action potential, voltage gated ion-channels, impulse transmission, neurotransmission, neurotransmitter receptors, synaptosomes, synaptotagmin, rod and cone cells in the retina, changes in the visual cycle, photochemical reaction and regulation of rhodopsin, odour receptors, learning and memory.

Chemistry of muscle contraction – actin and myosin filaments, theories involved in muscle contraction, mechanism of muscle contraction, energy sources for muscle contraction.

### Books Recommended

1. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments (6th ed). John Wiley & Sons. Inc.
2. Bruce Alberts and Dennis Bray (2013), Essential Cell Biology, (4th ed), Garland Science.
3. De Robertis, E.D.P. and De Robertis, E.M.F. (2010). Cell and Molecular Biology. (8th ed). Lippincott Williams and Wilkins, Philadelphia.
4. Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. (5th ed). Sunderland, Mass. Sinauer Associates, Inc.
5. Wayne M. Baker (2008) the World of the Cell. (7th ed). Pearson Benjamin Cummings Publishing, San Francisco. Cell Biology
6. P.S.Verma and V.K.Agarwal. (2004) Cell Biology, Genetics, Molecular Biology, Evolution and Ecology (14th ed), S.Chand and Company Ltd



- 7.** John E. Hall (2010). Guyton and Hall Textbook of Medical Physiology (12th ed), Saunders
- 8.** Best an Taylor (1990),Medical Physiology (12th ed), Lippincott Williams and Wilkins
- 9.** Walter F. Boron , Emile L. Boulpaep (2012) Medical Physiology (2nd ed), Saunders
- 10.**Anne Waugh (2010) Ross and Wilson Anatomy and Physiology in Health and Illness . Elsevier

## Elective - I

### 116PBYT04 - MICROBIOLOGY

#### UNIT-I

Molecular taxonomy- bacteria, viruses (DNA, RNA), algae, fungi and protozoa. Lytic cycle and lysogeny. Distribution and role of microorganisms in soil, water and air. Types of culture media, isolation of pure culture, growth curve and the measurement of microbial growth.

#### UNIT-II

Contamination and spoilage of foods – cereals, cereal products, fruits, vegetables, meat, fish, poultry , eggs, milk and milk products. General principles of food preservation- low temperature, drying, radiation, canning. Food fermentation- cheese, yoghurt, pickles and bread.

#### UNIT-III

Food poisoning- bacterial food poisoning, *Salmonella*, *Clostridium botulinum* (botulism), *Staphylococcus aureus*, fungal food poisoning – aflatoxin, food infection – *Clostridium*, *Staphylococcus* and *Salmonella*. Pathogenic microorganisms, *E. coli*, *Pseudomonas*, *Klebsilla*, *Streptococcus*, *Haemophilus* , & *Mycobacterium*, causes, control, prevention and cure.

#### UNIT-IV

Antimicrobial chemotherapy, General characteristics of antimicrobial agents. Mechanism of action – sulfonamides, sulphones and PAS . Penicillin, streptomycin- spectra of activity, mode of administration, mode of action, adverse effects and sensitivity test. Antiviral, and antiretroviral agents.

#### UNIT-V

Isolation, screening and maintenance of isolates of microbial strains, strain improvement through mutant selection. Downstream processing and *in situ* recovery of products. Industrial production of alcohol and  $\alpha$ -amylase. Industrial production of antibiotics- streptomycin. Organic acids- citric acid. Biofertilizers- Example, *Rhizobium* species and blue green algae. Single cell protein and biomass production.

#### Books Recommended:

1. Michael J.Pelczar Jr.(2001) Microbiology (5th ed), McGraw Hill Education (India) Private Limited
2. Frazier WC , Westhoff DC, Vanitha NM (2010) Food Microbiology (5th ed), McGraw Hill Education (India) Private Limited
3. Willey J and Sherwood L (2011) ,Prescott's Microbiology (8th ed) McGraw Hill Education (India)
4. Ananthanarayanan , Paniker and Arti Kapil (2013) Textbook of Microbiology (9th ed) Orient BlackSwan
5. Brooks GF and Carroll KC (2013) Jawetz Melnick&Adelbergs Medical Microbiology,(26th ed) McGraw Hill Education Greenwood D (2012) ,Medical Microbiology, Elsevier Health

## II Semester

### 216PBYT01 - ENZYMES AND ENZYME TECHNOLOGY

#### UNIT-I

Enzyme techniques- Isolation and purification of enzymes. Criteria of purity of enzymes , Enzyme activity units. Katal and International units. Enzyme assay- Different types - coupled enzyme assay. Applications of stopped flow techniques. Isoenzymes and their separation by electrophoresis with special reference to LDH. Significance of LDH and CK isoenzymes.

#### UNIT-II

Enzyme kinetics – Rate of enzymatic reaction , effect of substrate and enzyme concentration , pH, temperature on enzyme activity. M-M equation, L-B plot, Eadie Hofsee Plot. Determination of  $K_m$  .Catalytic efficiency, Sigmoidal kinetics , Allosteric enzymes = significance , structure and regulatory functions with special reference to aspartate transcarbamylase. Role of covalent modification in regulation of enzymes- regulation of glutamine synthase , glycogen synthase and glycogen phosphorylase.

#### UNIT-III

Coenzymes – cofactors and prosthetic groups. Structures and functions of coenzymes- reactions involving CoA, TPP, NAD<sup>+</sup>, NADP, biotin, folic acid, FMN, FAD, tetrahydrofolate and cobamide. Multienzyme complexes . Functions of pyruvate dehydrogenase and fatty acid synthase complexes. Methanogenesis, coenzymes involved in methanogenesis. Significance of Vitamin K- dependent carboxylation in blood clotting process.

#### UNIT-IV

Mechanism of enzyme action- Enzyme active site, mapping of active site, identification of amino acids like lysine, cysteine, serine and histidine in the active site. Enzyme specificity. Mechanism of enzyme action . Mechanisms of enzyme catalysis- covalent catalysis, proximity and orientation effect, acid-base catalysis

#### UNIT-V

Enzyme technology – production and industrial uses of enzymes like amylase, protease, pectinase, lipases and cellulose. Designer enzymes, abzymes, biosensors and ribozyme, Methods of Immobilization of enzymes and their applications. Enzymes as therapeutic agents.

#### Books Recommended:

1. David L.Nelson and Michael M.Cox (2012) Lehninger Principles of Biochemistry (6th ed), W.H.Freeman
2. Voet.D and Voet. J.G (2010) Biochemistry , (4th ed), John Wiley & Sons, Inc.
3. Robert K. Murray, Darryl K. Granner, Peter A. Mayes, and Victor W. Rodwell (2012), Harper's Illustrated Biochemistry, (29th ed), McGraw-Hill Medical
4. Trevor Palmer (1995), Understanding Enzymes (4th ed), Ellis Horwood Ltd  
5 Metzler D.E (2003). The chemical reactions of living cells (2nd ed), Academic Press.
5. Zubay G.L (1999) Biochemistry , (4th ed), Mc Grew-Hill. 7. Marangoni
6. AG.(2002), Enzyme Kinetics:A Modern Approach, Wiley-Blackwell

## 216PBYT02 - INTERMEDIARY METABOLISM I

### UNIT-I

Glycolysis – aerobic and anaerobic, inhibitors, and regulation. Feeder pathway- entry of hexoses into glycolysis, Pyruvate dehydrogenase complex-mechanism and regulation. Citric acid cycle- regulation. ATP/ADP cycle. Glyoxalate cycle and its regulation. Gluconeogenesis- source, key enzymes, reaction sequence and its regulation. Synthesis and degradation of starch.

### UNIT-II

Pentose phosphate pathway- significance and its regulation. Metabolism of glycogen and its regulation. Uronic acid pathway. Biosynthesis of N-linked and O-linked glycoproteins, mucopolysaccharides- Chondroitin sulphate, bacterial cell wall polysaccharide.

### UNIT-III

Metabolism of nucleotides-*De novo* synthesis and salvage pathways of purine and pyrimidine nucleotides. Regulation and inhibitors of nucleotide biosynthesis. Role of ribonucleotide reductase and its regulation. Degradation of purine and pyrimidine nucleotides.

### UNIT-IV

Versatile role of PLP as coenzyme.-transamination, deamination and decarboxylation. Trans methylation and one carbon transfer. Regulation of urea cycle, Inherited disorders of urea cycle enzymes. Conversion of amino acids to specialized products- Serotonin, GABA, epinephrine, nor-epinephrine, melanin, creatinine and NAD.

### UNIT-V

Biosynthesis and degradation of heme. Oxidation and reduction of inorganic sulphur compounds by microbes and plants. Sulpho transferases and their biological role- rhodanases, sulphatases, 3-mercapto pyruvate sulphur transferases. Oxidation of cysteine to sulphate and inter conversion of sulphur compounds.

### Books Recommended

1. David L.Nelson and Michael M.Cox (2012) Lehninger Principles of Biochemistry (6th ed), W.H.Freeman
2. Voet.D and Voet. J.G (2010) Biochemistry , (4th ed), John Wiley & Sons, Inc.
3. Robert K. Murray, Darryl K. Granner, Peter A. Mayes, and Victor W. Rodwell (2012), Harper's Illustrated Biochemistry, (29th ed), McGraw-Hill Medical
4. Metzler D.E (2003). The chemical reactions of living cells (2nd ed), Academic Press. 5.Zubay G.L (1999) Biochemistry , (4th ed), Mc Grew-Hill.
5. Ferrier DR (2013), Lippincott's Illustrated Reviews Biochemistry,(6th ed), Ippincott Williams & Wilkins.

## 216PBYT03 - INTERMEDIARY METABOLISM II

### UNIT-I

Oxidation of fatty acids-oxidation of saturated and unsaturated fatty acids ( $\alpha$ ,  $\beta$  &  $\omega$  oxidation) Oxidation of fatty acids with odd and even numbered carbon atoms. Regulation of  $\beta$  oxidation. Ketogenesis and its regulation. Biosynthesis of fatty acid – saturated and unsaturated, chain elongation, regulation.

### UNIT-II

Biosynthesis and degradation of triacylglycerol, phosphoglycerolipids-lecithin, cephalin, plasmalogens and phosphatidyl inositol, Sphingolipid-sphingomyelin, cerebroside, sulfatides, and gangliosides. Biosynthesis of prostaglandins, thromboxanes and leukotrienes and hydroxyl eicosanoic acids. Cholesterol biosynthesis and its regulation. Biosynthesis of bile acids. Lipoprotein metabolism-chylomicrons, VLDL, HDL and LDL.

### UNIT-III

Biosynthesis of essential amino acids.- Role and biological significance of glutamate dehydrogenase, glutamine and asparagine synthetase, lysine, proline and phenylalanine hydroxylase. Interconversion of amino acids - proline to glutamate, methionine to cysteine, serine to glycine. Biosynthesis of spermine and spermidine.

### UNIT IV

Degradation of amino acids –glucogenic and ketogenic amino acids. Formation of acetate from leucine and aromatic amino acid, pyruvate from cysteine, threonine and hydroxy proline,  $\alpha$ -keto glutarate from histidine and proline, succinate from methionine, threonine, valine and isoleucine, Oxaloacetate from aspartate, glycine and serine.

### UNIT V

Integration of Metabolism-Interrelationship of carbohydrate, protein and fat metabolism-role of acetyl CoA and TCA cycle. Interconversion of major food stuffs. Metabolic profile of the principal organs and their relationships.

### Books Recommended

1. David L.Nelson and Michael M.Cox (2012) Lehninger Principles of Biochemistry (6th ed), W.H.Freeman
2. Voet.D and Voet. J.G (2010) Biochemistry, (4th ed), John Wiley & Sons, Inc.
3. Robert K. Murray, Darryl K. Granner, Peter A. Mayes, and Victor W. Rodwell (2012), Harper's Illustrated Biochemistry, (29th ed), McGraw-Hill Medical
4. Metzler D.E (2003). The chemical reactions of living cells (2nd ed), Academic Press. 5.Zubay G.L (1999) Biochemistry, (4th ed), Mc Graw-Hill.
5. Ferrier DR (2013), Lippincott's Illustrated Reviews Biochemistry,(6th ed), Lippincott Williams & Wilkins.

## **216PBYP01 - PRACTICAL –I**

### **I. Biochemical studies and estimation of macromolecules**

1. Isolation and estimation of glycogen from liver.
2. Isolation and estimation of DNA from animal tissue.
3. Isolation and estimation of RNA from yeast.
4. Separation of starch from plant source and assessment of its purity.
5. Denaturation of DNA and absorption studies at 260nm.
6. Denaturation of Protein and absorption studies at 280nm.

### **II. Colorimetric estimations**

1. Estimation of lactate.
2. Estimation of pyruvate.
3. Estimation of tryptophan.
4. Estimation of protein by Lowry's method.

### **III. Estimation of minerals and vitamins**

1. Estimation of calcium and iron.
2. Estimation of vitamins – Thiamine, Riboflavin.

### **IV. Group experiment**

Subcellular Organelles - Separation of Mitochondria and Nucleus and identification of the subcellular organelles using marker enzymes.

### **Books Recommended**

1. David Plummer (2001) An Introduction to Practical Biochemistry (3rd ed) McGraw Hill Education (India) Private Ltd
2. Jayaraman, J (2011), laboratory Manual in Biochemistry, New age publishers
3. Varley H (2006) Practical Clinical Biochemistry (6th ed) , CBS Publishers

## **216PBYP02 - PRACTICAL-II SUBJECT CODE:**

Isolation, purification and assay of alkaline phosphatase from kidney.

1. Assay of amylase.
2. Assay of superoxide dismutase.
3. Assay of ATPase.
4. Assay of catalase.
5. Assay of acid phosphatase.
6. Effect of pH, temperature substrate concentration and inhibitors on activity of alkaline phosphatase
7. Test for blood grouping (Haemagglutination).
8. Culture and inoculum preparation.
9. Separation of lipids by TLC.
10. Separation of proteins by SDS-PAGE.

### **Books Recommended**

1. David Plummer (2001) An Introduction to Practical Biochemistry (3rd ed) McGraw Hill Education (India) Private Ltd
2. Jayaraman, J (2011), laboratory Manual in Biochemistry, New age publishers  
Varley H (2006) Practical Clinical Biochemistry (6th ed) , CBS Publishers

## Elective II

### 216PBYT04 - ENERGY AND DRUG METABOLISM

#### UNIT-I

Thermodynamic- principles in biology- Concept of entropy, enthalpy and free energy change. Redox systems. Redox potential and calculation of free energy. Biological oxidation – Oxidases, dehydrogenases, hydroperoxidases, oxygenases. Energy rich compounds – phosphorylated and non-phosphorylated. High energy linkages.

#### UNIT-II

Electron transport chain-various complexes of ETC, Q-cycle. Inhibitors of ETC. Oxidative phosphorylation-P/O ratio, chemiosmotic theory. Mechanism of ATP synthesis - role of F<sub>0</sub>-F<sub>1</sub> ATPase, ATP-ADP cycle. Inhibitors of oxidative phosphorylation ionophores, protonophores. Regulation of oxidative phosphorylation.

#### UNIT-III

Light reaction-Hills reaction, absorption of light, photochemical event. Photo ETC- cyclic and non-cyclic electron flow. Photophosphorylation-role of CF<sub>0</sub>-CF<sub>1</sub> ATPase. Dark reaction- Calvin cycle, control of C<sub>3</sub> pathway, and Hatch-Slack pathway (C<sub>4</sub> pathway), Photorespiration.

#### UNIT-IV

Energy sources of brain, muscle, liver, kidney and adipose tissue. Amphibolic nature of Citric acid cycle. Anaplerotic reaction. Inhibitors and regulation of TCA cycle. Transport of extra mitochondrial NADH – Glycerophosphate shuttle, malate aspartate shuttle. Energetics of metabolic pathways – glycolysis, (aerobic and anaerobic), citric acid cycle, beta oxidation.

#### UNIT-V

Activation of sulphate ions – PAPS, APS, SAM and their biological role. Metabolism of xenobiotics – Phase I reactions – hydroxylation, oxidation and reduction. Phase II reactions – glucuronidation, sulphation, glutathione conjugation, acetylation and methylation. Mode of action and factors affecting the activities of xenobiotic enzymes.

#### Books Recommended

1. David L.Nelson and Michael M.Cox (2012) Lehninger Principles of Biochemistry (6th ed), W.H.Freeman
2. Voet.D and Voet. J.G (2010) Biochemistry , (4th ed), John Wiley & Sons, Inc.
3. Robert K. Murray, Darryl K. Granner, Peter A. Mayes, and Victor W. Rodwell (2012), Harper's Illustrated Biochemistry, (29th ed), McGraw-Hill Medical
4. Metzler D.E (2003). The chemical reactions of living cells (2nd ed), Academic Press. 5.Zubay G.L (1999) Biochemistry , (4th ed), Mc Grew-Hill.
5. Ferrier DR (2013), Lippincott's Illustrated Reviews Biochemistry,(6th ed), Ippincott Williams & Wilkins
6. Devlin RM (1983) Plant Physiology (4th ed), PWS publishers 8. Taiz L , Zeiger E (2010), Plant Physiology (5th ed), Sinauer Associates, Inc



## EXTRA DISCIPLINARY PAPER-I

### 216PBYT05 - ESSENTIAL BIOCHEMISTRY

#### UNIT-I

Major nutrients of food - energy yielding and protective food nutrients. Energy value of foods – units of energy, calorific value of carbohydrates, lipids and proteins. Energy requirements for infants, children, adolescents, adults, pregnant women and lactating mothers. Significance of balanced diet.

#### UNIT-II

Nutritional aspects of carbohydrates – Different carbohydrates in the diet – utilization. Glycosuria, Diabetes mellitus – types and symptoms. Dietary management of Diabetes mellitus – food chart for diabetic patients-Diabetic coma.

#### UNIT-III

Nutritional aspects of lipids – lipids present in diet and their functions, essential fatty acids, lipoproteins , lipemia –ketosis– atherosclerosis – symptoms. Role of diet in the management of atherosclerosis and hyperlipidemia.

#### UNIT-IV

Nutritional aspects of proteins – essential amino acids, nitrogen balance, positive and negative nitrogen balance. Dietary sources of proteins – protein malnutrition in children, Kwashiorkor and Marasmus.

#### UNIT- V

Vitamins – sources, recommended daily allowance (RDA) and functions of vitamins A, D and B complex (thiamine, riboflavin, niacin, pyridoxine, folic acid and cobalamine . Deficiency disorders of vitamins A, D and B complex). Minerals – essential minerals of calcium and iron. Deficiency disorders of anemia and rickets.

#### Books Recommended

1. Garrow, JS , James WPT and Ralph A (2000) . Human nutrition and dietetics (10th ed) Churchill Livingstone
2. Andreas M. Papas (1998). Antioxidant Status, Diet, Nutrition, and Health (1st ed) CRC Press
3. M.Swaminathan ( 1995 ) Principles of Nutrition and Dietetics. Bappco
4. Margaret Mc Williams (2012) . Food Fundamentals ( 10th ed) Prentice Hall
5. Tom Brody (1998). Nutritional Biochemistry (2nd ed) , Academic Press, USA

### III Semester

#### 316PBYT01 - BIOTECHNOLOGY

##### Unit I

Basic techniques: Cutting DNA molecules, Restriction digestion, isoschizomers, joining DNA molecules – DNA ligase, double linkers, adaptors, homopolymer tailing, selection of recombinants and screening – genetic methods, immuno chemical methods, South-Western screening, Nucleic acid hybridization methods, synthesis of probes, radio-active and non-radioactive labelling of probes, analysing DNA sequences methods: Automated sequencing, Next Generation Sequencing Analysis (NGS), *in silico* sequence analysis,

##### Unit II

Cloning strategies: Cloning vectors – plasmids (pBR 322, pUC 18), phage and M 13, cosmids, phasmids, expression vectors, ; pMal; GST; pET-based vectors, Protein purification, His-tag; GST-tag; MBP-tag, Inclusion bodies- Methodologies to reduce formation of inclusion bodies, yeast vectors – YEP, YIP, YRP, YCP and YAC, shuttle vectors. Genomic DNA libraries, chromosome walking, cDNA cloning, RACE, RAPD. Site directed mutagenesis of cloned genes.

##### Unit III

Animal cell culture- media, primary culture, contamination, disaggregation, subculturing. Introduction of genes into animal cells: Reporter genes, selectable markers, viral vectors – SV 40, Retroviruses and Baculovirus, Adenoviruses, Transferring genes into animal cells in culture, oocytes, eggs, embryos and specific tissues, transgenic animals, Creation of knock out mice. Hazards and safety aspects of biotechnology. Patents and IPR.

##### Unit IV

Plant tissue culture- media, callus and protoplast cultures. Production of biochemicals from plant cell culture. Micropropagation Agro bacterium – mediated gene transfer to plant cells, Plant based vectors, Ti and Ri as vectors microprojectiles, transgenic plant technology – for pest resistance, herbicide tolerance, delay of fruit ripening and use of plants to produce commercially important proteins.

##### Unit V:

Applications of recombinant DNA technology: production of insulin and growth hormone in *E. coli*.

Genome mapping, types of gene map, molecular markers. The Human Genome Project- goals, results, potential benefits and risks. DNA microarrays. Techniques for separation and identification of proteins, 2D-gel electrophoresis, mass spectrometry, MALDI-TOF. Protein arrays. Applications of proteomics. Bioinformatics- introduction, biological databases, database similarity searches- FASTA, BLAST. Multiple sequence alignment, construction of a phylogenetic tree.

##### Books Recommended

1. David Freifelder (1992) Essentials of Molecular Biology (2nd ed) Jones & Bartlett Pub
2. Click B.R. and Pasternark J.J (2010). Molecular Biotechnology: Principles and Applications of Recombinant DNA. (4th ed) American Society for Microbiology
3. James D. Watson , Amy A. Caudy , Richard M. Myers , Jan Witkowski (2006) , Recombinant DNA: Genes and Genomes - a Short Course (3rd ed),W.H.Freeman & Co
4. Satyanarayana U (2008), Biotechnology, Books & Allied (P) Ltd.
5. Brown TA, (2010) Gene Cloning and DNA Analysis (6th ed), Wiley-Blackwell
6. Green MR and Sambrook J (2012) Molecular Cloning: A Lab Manual(4th ed) Cold Spring Harbor Laboratory Press
7. Sandy B. Primrose and Richard M. Twyman (2002), Principles of Gene Manipulation(6th ed) Wiley-Blackwell

## **316PBYT02 - CLINICAL BIOCHEMISTRY-I**

### **UNIT-I**

Biochemical investigations in diagnosis, prognosis, monitoring, screening. Specimen collection- blood and urine. Factors influencing biochemical variables. Sample analysis and reporting- precision, accuracy, specificity, sensitivity. Sources of error. Interpretation of results- normal reference ranges. Good laboratory practices.

### **UNIT-II**

Applications of Clinical Biochemistry-Biological specimens used for the diagnosis. Preservation of biological specimens -blood, urine, CSF and amniotic fluid. Diabetes mellitus-causes, pathology, types, Metabolic complications- acute and long-term, Diagnosis-by GTT, Glycated Haemoglobin. Management- diet and life-style modifications and anti-diabetic drugs. Hypoglycaemia.

### **UNIT-III**

Disorders of blood cells- Hemolytic, iron deficiency and aplastic anemia and diagnosis. Porphyrias, Thrombocytopenia, Causes of leucopenia, leukemia and leucocytosis. Disorders of blood clotting mechanism - Von Willebrand's disease, Hemophilia A, B and C, diagnostic test for clotting disorders.

### **UNIT-IV**

Disorders of lipid metabolism -Normal levels of blood lipids and their functions. Hyperlipidemia -Atherosclerosis -causes and symptoms-diagnosis. Hypolipidemic agents, Hyper and Hypolipoproteinemia- Types and pathology.

### **UNIT-V**

Disorders of calcium and phosphorous metabolism. Factors affecting blood phosphorous and calcium levels..Biological functions of calcium and phosphorous. Role in bone formation. Blood calcium homeostasis. Role of PTH and calcitonin. Hypo and Hypercalcemia).

### **Books Recommended**

1. Thomas M.Devlin (2014) Textbook of Biochemistry with Clinical Correlations (7th ed). John Wiley & Sons
2. Montgomery R, Conway TW, Spector AA (1996),Biochemistry: A Case-Oriented Approach (6th ed), Mosby Publishers, USA.
3. Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics (2014) (7th ed),Saunders
4. Dinesh Puri, (2002), Text book of Biochemistry : A clinically oriented approach - Churchill Livingstone Inc., India.
5. M.N.Chatterjee and Rana Shinde (2007).Textbook of Medical Biochemistry (7th ed)

## 316PBYT03 - MOLECULAR BIOLOGY

### UNIT-I

Genetics-Mendel laws of inheritance-dominance-complete, incomplete and co dominance, multiple alleles-gene mapping in haploids and diploids, recombination mapping- restriction mapping- mode of gene information transfer in bacterial-conjugation, transformation and transduction.

### UNIT-II

The bacterial chromosome and plasmids. Organization of eukaryotic chromatin-nucleosomes, 30 nm fiber, higher order structure. Organization of organelle genomes. Enzymes and mechanism of prokaryotic and eukaryotic replication. Telomeres, telomerase and end replication. Regulation of replication.

### UNIT-III

Mutation, spontaneous and induced mutation, molecular mechanisms of mutation. DNA repair mechanisms-Direct repair, excision repair, mismatch repair, recombination repair, SOS response, eukaryotic repair system. Recombination and mobile genetic elements- the Holliday model, the general recombination in *E.coli*, site specific recombinations, transposons and retroposons.

### UNIT-IV

Transcription- Prokaryotic and Eukaryotic transcription, Subunits of RNA polymerase, eukaryotic RNA polymerases, *E.coli* and eukaryotic promoters and enhancers. Transcription factors. mechanism of prokaryotic and eukaryotic transcription. Post Transcriptional modifications- mRNA 5' capping and 3' polyadenylation, splice, spliceosomes assembly, alternative splicing, Regulation of Transcription- Trp and Lac operon. Gene regulation, levels of gene expression, methylation.

### UNIT-V

Ribosomes, Genetic code, nature of genetic code, wobble hypothesis, activation, initiation, elongation, termination of translation in prokaryotes, inhibitors of protein synthesis. Protein synthesis in eukaryotes and its regulation. Post translational modification. Protein sorting- signal peptides, targeting of mitochondria, secretor and lysosomal proteins. Protein degradation- the ubiquitin pathway.

### Books Recommended:

1. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments (6th ed). John Wiley & Sons. Inc.
2. Bruce Alberts and Dennis Bray (2013), Essential Cell Biology, (4th ed), Garland Science.
3. De Robertis, E.D.P. and De Robertis, E.M.F. (2010). Cell and Molecular Biology. (8th ed). Lippincott Williams and Wilkins, Philadelphia.
4. James.D.Watson (2013) Molecular Biology of the Gene (7th ed), Benjamin Cummings
5. Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. (5th ed). Sunderland, Mass. Sinauer Associates, Inc.
6. David Freifelder (1992) Essentials of Molecular Biology (2nd ed) Jones & Bartlett Pub

## Elective -III

### 316PBYT04 - BIOSTATISTICS

#### UNIT – I

Nature of biological and clinical experiments – Collection of data in experiment- Primary and secondary data. Methods of data collection. Classification and tabulation. Different forms of diagrams and graphs related to biological studies. Measures of Averages- Mean, Median, and mode. Use of these measures in biological studies.

#### UNIT- II

Measures of Dispersion for biological characters – Quartile deviation, Mean deviation, Standard deviation and coefficient of variation. Measures of skewness and kurtosis. Correlation and regression – Rank correlation – Regression equation. Simple problems based on biochemical data.

#### UNIT-III

Basic concepts of sampling- Simple random sample stratified sample and systemic sampling. Sampling distribution and standard error. Test of significance based on large samples. Test for mean, difference of means, proportions and equality of proportions.

#### UNIT-IV

Small sample tests – Students, „t“ test for mean, difference of two way means, tests for correlation and regression coefficients. Chi-square test for goodness of a non independence of attributes. F test for equality of variances. ANOVA- one way and two way. Basic concept related to biological studies.

#### UNIT-V

Operating systems and application programmes, MS excel and Statistical package for social sciences (SPSS) for basic statistical functions, Regression, correlation, ANOVA, Chi square test with specific biological examples.

#### Books Recommended

1. Zar, J.H. (1984) "Bio Statistical Methods", Prentice Hall, International Edition
2. Sundar Rao P. S.S., Jesudian G. & Richard J. (1987), "An Introduction to Biostatistics", 2nd edition, . Prestographik, Vellore, India, .
3. Warren,J; Gregory,E; Grant,R (2004), "Statistical Methods in Bioinformatics",1st edition, Springer
4. Milton,J.S.(1992),. "Statistical methods in the Biological and Health Sciences", 2nd edition ,Mc Graw Hill,
5. Rosner,B (2005), "Fundamentals of Biostatistics", Duxbury Press
6. SPSS for you by A.Rajathi and P.Chandran, MJP publishers
7. An introduction to Biostatistics- Second revised edition by N.Gurumani
8. Statistical methods for biologists by S.Palinichamy & M.Manoharan

## EXTRA DISCIPLINACY PAPER-II

### 316PBYT05 - LIFE STYLE – DISEASE AND PREVENTION

#### UNIT-I

Obesity- prevalence –causes, consequences, symptoms- Coronary Heart Disease and type 2 diabetes mellitus- lifestyle and dietary management of obesity.

#### UNIT-II

Hypertension – blood pressure-normal level of blood pressure, dietary management of hypertension, stroke and chronic renal failure due to hypertension. Kidney stone-causes, types, symptoms and treatment (only Lithotropy), dietary management for prevention of kidney stones.

#### UNIT-III

Cancer-types of cancer, aetiology of breast cancer diagnosis (self examination, Mammography) and treatment (radiation, chemotherapy, surgery).Cervical cancer-causes, Types of cervical cancer, symptoms, diagnosis and treatment (radiation, chemotherapy, surgery). Cigarette smoking and symptoms, diagnosis and treatment (chemotherapy)

#### UNIT-IV

Aging-Factors influencing aging. Age related diseases- dementia, osteoporosis, Osteo arthritis - causes sign and symptoms, preventive measures of aging with special reference to antioxidants.

#### UNIT-V

Gallstones- causes, factors, aetiology of gall stones, types of gall stones, symptoms, preventive aspects of gall stone. Drug therapy – ursodeoxy cholic acid, surgical treatment and dietary management. – Ulcer – causes and prevention.

#### Books Recommended

1. Thomas M.Devlin (2014) Textbook of Biochemistry with Clinical Correlations (7th ed). John Wiley & Sons 27
2. Montgomery R, Conway TW, Spector AA (1996),Biochemistry: A Case-Oriented Approach (6th ed), Mosby Publishers, USA.
3. Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics (2014) (7th ed),Saunders
4. Dinesh Puri, (2002), Text book of Biochemistry : A clinically oriented approach - Churchill Livingstone Inc., India.
5. M.N.Chatterjee and Rana Shinde (2007).Textbook of Medical Biochemistry.

## IV Semester

### 416PBYT01 - HORMONES

#### Unit I:

Hormones – Classification, Biosynthesis, circulation in blood, modification and degradation. Mechanism of hormone action, Target cell concept – Feedback control and regulation. Hormones of Hypothalamus and pituitary – Vasopressin and oxytocin, Hypothalamic releasing factors. Anterior pituitary hormones – actions and feedback regulation of synthesis. Growth promoting, Lactogenic hormones. Glycoprotein hormones, the POMC family, Endorphins.

#### Unit II:

Pancreatic hormones – cell types of the islets of Langerhans. Insulin – structure, Biosynthesis, regulation of secretion, Biological actions and mechanism of action. Glucagon, somatostatin and pancreatic polypeptide. Insulin like growth factors – structure, biological action. Gastrointestinal hormones – secretin, gastrin, cholecystokinin – biological action, regulation of secretion.

#### Unit III:

Thyroid hormones – synthesis, secretion, transport, biological action, metabolic fate and mechanism of action, regulation. Parathyroid hormone – biological action, regulation of calcium and phosphorus metabolism and the role of calcitonin. Calcitriol – Biosynthesis, transport, functions, mechanism of action.

#### Unit IV:

Adrenal hormones – Glucocorticoids, mineralocorticoids, synthesis, secretion, transport, metabolism and excretion. Biological effects. Mechanisms of action, adrenal androgens, metabolic effects and functions. Adrenal medulla – Catecholamines, biosynthesis, storage, metabolism, regulate of synthesis. Chemical nature and biological action of prostaglandins.

#### Unit V:

Gonadal Hormones – Chemical Nature. Biosynthesis, metabolism and mechanism of action of androgen, estrogen and progesterone. Factors involved in the regulation of gonadal hormone activities. Ovarian cycle. Pregnancy, biochemical changes in pregnancy.

#### Books Recommended:

1. Larsen PR (2002) Williams Text Book of Endocrinology(10th ed) Saunders
2. Wilson JD and Foster DW (1998) Williams Textbook of Endocrinology, (9th ed) Saunders 29
3. Laycock J and Lee J (1979), Essential Endocrinology (1st ed) Oxford University Press
4. Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics (2014) (7th ed),Saunders

## 416PBYT02 - CLINICAL BIOCHEMISTRY-II

### UNIT-I

Clinical enzymology, functional and non-functional serum enzymes –Normal levels. Clinical significance of AST, ALT, ALP, ACP, CK,  $\gamma$ -GT, amylase, pseudocholinesterase. Enzyme pattern in diseases- myocardial infarction and liver diseases. Isoenzymes – LD, CK and ALP. Enzymes as therapeutic agents.

### UNIT-II

Inborn errors of metabolism- Inborn errors of carbohydrate metabolism- Galactosemia, fructosuria, Glycogen storage diseases -causes and symptoms Inborn errors of lipid metabolism -Taysach's disease, Gaucher's and Niemannpick's disease- causes and symptoms. Inborn errors of aminoacid metabolism-phenyl ketonuria, Tyrosinemia, Maple syrup urine disease and alkaptonuria- causes and symptoms. Amniocentesis, prenatal detection of inborn errors of metabolism in developing fetus- Autosomal recessive mode of inheritance- cystic fibrosis, X linked recessive inheritance-Duchenne muscular dystrophy .

### UNIT-III

Liver function tests based on synthesis, excretion and detoxification. Jaundice- classification, pathology and Differential diagnosis. Plasma protein changes in liver diseases. Hepatitis A,B and C. Cirrhosis and fibrosis. Portal hypertension and hepatic coma. Acute phase proteins -CRP, Haptoglobins,  $\alpha$ -fetoprotein, ferritin and transferrin-their clinical significance.

### UNIT-III

Renal function tests -tests for glomerular and tubular function-Acute and chronic renal failure-Glomerulonephritis, Nephrotic syndrome, uraemia-urinary calculi- Nephrocalcinosis and Nephrolithiasis-causes, pathology and symptoms. Dialysis- Hemodialysis and peritoneal dialysis.

### UNIT-IV

Hormonal disorders-causes and the pathology of thyroid disorders-Hypothyroidism and Hyperthyroidism-Diagnostic methods – disorders associated with adrenal, pituitary and sex hormones- Addison's disease, Cushing's syndrome, pituitary tumour, Hypopituitarism, Hypogonadism-Causes, pathology ,symptoms and diagnosis.

### Books Recommended

1. Thomas M.Devlin (2014) Textbook of Biochemistry with Clinical Correlations (7th ed). John Wiley & Sons
2. Montgomery R, Conway TW, Spector AA (1996),Biochemistry: A Case-Oriented Approach (6th ed), Mosby Publishers, USA.
3. Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics (2014) (7th ed),Saunders
4. Dinesh Puri, (2002), Text book of Biochemistry : A clinically oriented approach - Churchill Livingstone Inc., India.
5. M.N.Chatterjee and Rana Shinde (2007).Textbook of Medical Biochemistry (7th ed)



### **416PBYP01 - PRACTICAL-III**

- 1.** Antioxidant status: Estimation of super oxide dismutase and catalase.  
Estimation of vitamine E and C.
- 2.** Haematology: RBC count, WBC count – total and differential count, ESR, PCV, MCV. Estimation of hemoglobin.
- 3.** LPO, Nitrite, glutathione and GPX.
- 4.** Estimation of Sodium, Potasium and Calcium.
- 5.** Estimation of ALT, AST, CPK by kit method.
- 6.** Liver function test: Estimation of bilirubin – direct and indirect. Estimation of plasma protein, A/G ratio, Thymol turbidity test, Assay of serum glutamate oxaloacetate transaminase, alkaline phosphatase, isoenzyme separation of LDH by electrophoresis.
- 7.** Renal function test: Qualitative tests for normal and pathological components of urine. Estimation of blood and urine urea, creatinine, creatine and uric acid. Urea Clearance test. Chemical analysis of kidney and gall stones.
- 8.** Estimation of blood glucose by orthotoluidine and glucose oxidase method. Determination of glycosylated Hb. Glucose tolerance test.
- 9.** Lipid profile: Estimation of cholesterol by Zak’s method, lipoprotein profile, estimation of ketone bodies, estimation of triglycerides, free fatty acids and phospholipids.



## ELECTIVE PAPER –IV

### 416PBYT05 - SIGNAL TRANSDUCTION

#### Unit I:

General functions and structure of signaling pathways, Mechanism of intracellular and intercellular signal transduction, Hormone and hormone analogues; Recognition and interaction of hormones with receptors , Signal amplification , regulation of inter and intracellular signaling; Receptor superfamilies and subtypes., intra cellular signaling molecules-secondary messengers; Divergence, convergence and cross talk.

**Unit II:** Protein kinases and protein phosphatases : Classification, structure protein kinases, ser/ thr protein kinases , Regulation of PKA, PKB, PKC, Ca<sup>2+</sup>/ calmodulin-dependent protein kinases , Structure and regulation of phosphatases, I,2A,2B,PP2A; subcellular localization.

#### Unit III:

G- protein coupled signal transduction pathways: Transmembrane Receptors– Structure, Major classes of trimeric G proteins based on Gs unit, mechanism of signal transmission, toxins as tools in characterization of G- protein, GTPase switches, G proteins that regulate ion channels; G-protein and gene control.

#### Unit IV:

Signaling and Gene control: TGF receptors; Cytokine receptors and JAK – STAT; Receptor Tyrosine Kinases(RTK), activation of ras, genetic analysis – drosophila eye development; MAPK; Phosphoinositide cascade, NF-κB; signal induced protein cleavage, Down modulation of receptor signaling.

#### Unit V:

Nuclear receptors, Principles of signaling by nuclear receptors, Classification and structure of nuclear receptors, Mechanism of transcriptional regulation by nuclear receptors, transactivation .Steroid hormone signaling

#### Books Recommended

1. John Hancock (2010), Cell signalling(3rd ed) Oxford University Press
2. Wendell Lim , Bruce Mayer (2014) Cell Signalling (Garland Science)
3. Lewin B:Genes 8; Prentice Hall; International Ed edition (2004)
4. Watson JD, Baker TA, Bell S, Gann A, Levine M, Losick R: Molecular Biology of the Gene; Addison Wesley; (2004)
5. Alberts B, Bray D, Hopkin K, Johnson A, Lewis J, Raff M, Roberts K, Walter P: Essential Cell Biology; Garland Science (2003) 6.Lodish H, Darnell JE: Molecular Cell Biology; W.H.Freeman & Co Ltd; (2003)

## **416PBYT06 - IMMUNOCHEMISTRY**

### **UNIT-I**

Scope and advances in immunology. Achievements in the field of immunology  
Immunity – innate & acquired immunity– factors contributing for innate immunity –  
role of lymphokines in acquired immunity. Vaccines – different types – Attenuated  
vaccines-Preventive vaccines-DNA vaccines- . Antigenic competition. Contradictions  
in vaccinotherapy and Production of vaccines.

### **UNIT-II**

Antibodies – classification, structure, properties & biological functions – abnormal  
immunoglobulins – isohemeagglutinins. Monoclonal antibodies – commercial  
production by hybridoma technique & applications. Cooper Antigens – nature  
& different types, classification based on epitope. Iso and neo antigens. MHC gene  
arrangement and functions of Class I and Class II antigens in human and  
mice. Factors affecting antigenicity and immunogenicity of antigens. Complement  
system- activation by direct and alternate pathways. Biological functions of  
complements.

### **UNIT-III**

Antigen – Antibody reactions- General mechanism – Qualitative and quantitative  
determination of antigen-antibody reactions. Diagnostic tests based on antigen-  
antibody reactions – with special reference to typhoid, syphilis, HIV & Retro virus  
infection. ELISA, RIA and immuno fluorescence techniques. Cross reaction with  
examples.

### **UNIT-IV**

Immune response – humoral & cell mediated immune response – ontogeny of T & B  
cells – clonal selection theory of antibody formation. Primary & secondary immune  
response. Immune response against bacterial, viral and fungal antigens. Immuno  
survience.

### **UNIT-V**

Pathology of immune system – Autoimmune disorders – causes and effects –  
systemic & localized types. Hypersensitivity reactions – causes & effects – different  
types of hypersensitivity reactions (eg) allergy, atopy, anaphylatoxis, serum  
sickness. Disorders associated with complements. Transplantation and transfusion  
immune reactions. Graft rejection and adverse reactions of mismatched blood  
transfusion.

### **Books Recommended**

1. Judy Owen , Jenni Punt Kuby (2013) ,Immunology (Kindt, Kuby Immunology)  
(7th ed) W. H. Freeman & Co
2. Janis Kuby (1997),Immunology (3rd ed), W. H. Freeman & Co
3. David Male (2012) , Immunology, (Immunology (Roitt) (8th ed), Saunders.
4. Ivan Roitt and Peter Delves (2001), Roitts Essential Immunology (10th ed)
5. Donald M. Weir (1998), Immunology (8th ed) , Churchill Livingstone.

**Registrar**