

## SEMESTER V

### Paper V : ENZYMES & INTERMEDIARY METABOLISM - I

#### Unit I

##### **Introduction and Enzyme Catalysis:**

History, General characteristics, nomenclature, IUB Enzyme classification. Definitions with examples of substrate, Holo-enzyme, Apoenzyme, Co-enzyme, Prosthetic group, Cofactors, Activators, Active site, Metallo enzyme, Isoenzyme, Monomeric enzymes, oligomeric enzymes and Multienzyme complexes. Enzyme specificity, Units of Enzymes activity (IU, Katal, Enzyme turn over rate) Nature of Enzymatic and Non Enzymatic Catalysis

Role of cofactors in enzyme catalysis (with reference to  $\text{NAD}^+/\text{NADP}^+$ , FMN/FAD, TPP, coenzyme A, Biotin, Pyridoxal phosphate and metal ions) Acid base catalysis, covalent catalysis, proximity and orientation effects, strain and distortion theory.

Mechanism of enzyme action, enzyme-substrate complex, Theories of ES interaction (Fischer template (or) Lock & Key Model and Koshland's Induced Fit Model). Bonds forming ES complex.

##### **Unit II:- Enzyme Isolation and Purification:**

Homogenisation technique, Intracellular localization of enzymes

Separation Procedure based on Molecular Size-Dialysis, Ultra filtration Molecular sieve chromatography.

Separation procedure based on solubility-salting in and salting out, Isoelectric precipitation.

Separation procedure based on electric charge-Electrophoresis, Ion-exchange chromatography.

##### **Unit III:- Enzyme Kinetics and Inhibition:**

Derivation of Michaelis Menton equation,  $K_m$  and  $V_{max}$  and its significance, Line-weaver Burk plot and Hadie Hofster plot,

Factors regulating enzyme action-pH, Temperature, activators and co-factors.

Enzyme inhibition - reversible and irreversible inhibition, Competitive, Non-competitive and uncompetitive inhibition. (Derivation not required) Allosteric enzymes.

##### **Unit IV:- Bioenergetics and biological Oxidation:**

Free energy, Role of high energy phosphates as energy currency of the cell, Free energy of hydrolysis of ATP and other organophosphates. Structure of mitochondria, Components of electron transport chain (NADH, Flavin linked dehydrogenase, Coenzyme Q of cytochromes) oxidative phosphorylation - Basic concept only. Inhibitors and uncouplers of oxidative phosphorylation.

## **Unit V:- Enzyme Technology:**

Immobilization of enzymes, Methods of immobilization(Adsorption, covalent binding entrapment and encapsulation). Industrial and Medicinal(Therapeutic) application of immobilized enzymes.

### **BOOKS RECOMMENDED**

Fundamentals of Enzymology

Nicholas C Price

Oxford University Press, London

1. Understanding Enzymes

Trevor Palmer

Third Edition, (1991)

Ellis Harwood Ltd.,

2. A.Lehninger -Principles of Biochemistry.

David L Nelson & Michael M Cox

Third Edition (2002)

Macmillan Work Publishers.

3. Enzymes Structure and Function

S Blackburn

Marel Dekker Inc, New York

4. Biochemistry

Lubert Stryer

Fourth Edition

W H Freeman & Co., San Francisco

5. The Chemical Kinetics of Enzyme Action

K J Laidler & P S Bunting

Oxford University Press, London

6. Harper's Illustrated Biochemistry

Robert K Murray & Daryl K Granner

26<sup>th</sup> International Edition, (2003)

McGraw Hill

7. Hand Book of Enzyme Biotechnology

Alan Weissman

Second Edition

## SEMESTER V

### Paper VI : ENZYMES & INTERMEDIARY METABOLISM – II

#### Unit I :-

Introduction to metabolic Pathways and Carbohydrate metabolism:

The basic metabolic pathways, Anabolism and catabolism, Amphibolic Pathways.

Reaction and Energetics of Glycolysis, TCA cycle and glyoxalate cycle, Glycogen metabolism- Glycogenesis, Glycogenolysis and its regulation. Gluconeogenesis, Metabolic reaction and biological significance of HMP shunt.

#### Unit II:- Lipid Metabolism:

##### Anabolism:

Fatty Acid Synthase- A multi enzyme Complex. Biosynthesis of saturated and Unsaturated fatty acid(Palmitate, Oleate). Microsomal system for fatty acid chain elongation. [elongase]. Biosynthesis of Triacyl glycerol, Important phospholipids(Lecithin, Ethanolamine, Phosphatidyl Serine, Sphingomyelin) Biosynthesis of cholesterol and Regulation.

##### Catabolism:

Degradation of Triglycerides and Phospholipids, Transport of fatty acids into mitochondria [Carnitine transport system]. General Oxidation of fatty acids ( $\alpha$ ,  $\beta$ ,  $\omega$ ) Oxidation of palmitate & linoleic acid. Formation of ketone bodies.

#### Unit III:- Amino Acid Metabolism:

Amino acid Pool, Sources and utilization of amino acids, General reactions (Role of D and L amino acid Oxidases, dehydrogenases and Pyridoxal Phosphate in amino acid Catabolism)

Transamination, deamination and decarboxylation, urea cycle and Nitrogen balance.

Biosynthesis of Creatine

#### Unit IV:- Nucleotide Metabolism:

De novo purine nucleotide synthesis, salvage pathway of purine and inhibitors, Degradation of purine nucleotides, Pyrimidine Synthesis and inhibitors, Degradation of pyrimidine nucleotides, Conversion of ribonucleotides to deoxyribonucleotides, Uricotelic and Uriotelic systems.

#### Unit V:- Metabolism of Xenobiotics:

General metabolism of Xenobiotics (Detoxification by oxidation, hydroxylation, hydrolysis. Conjugation and reduction)

Inter-relationship of carbohydrate, Protein and fat metabolism, Role of Acetyl CoA and TCA cycle in inter-relationship.

## BOOKS RECOMMENDED

Fundamentals of Enzymology  
Nicholas C Price  
Oxford University Press

- 1) Understanding Enzymes  
Trevor Palmer  
Third Edition, (1991)  
Ellis Harwood Ltd.,
- 2) A. Lehninger - Principles of Biochemistry.  
David L Nelson &  
Michael M Cox  
Third Edition (2002)  
Macmillan Work Publishers.
- 3) Enzymes Structure and Function  
S Blackburn  
Marel Dekker Inc, New York
- 4) Biochemistry  
Fourth Edition  
W H Freeman & Co., San Francisco

- Lubert Stryer
- 5) The Chemical Kinetics of Enzyme Action  
K J Laidler & P S Bunting  
Oxford University Press, London
  - 6) Harper's Illustrated Biochemistry  
Robert K Murray &  
Daryl K Granner  
26<sup>th</sup> International Edition, (2003)  
Mc Graw Hill
  - 7) Hand Book of Enzyme Biotechnology  
Alan Weissman  
Second Edition
  8. Biochemistry  
Lubert Stryer  
Fourth Edition  
W H Freeman & Company.,  
San Francisco

## SEMESTER - V

### PAPER VII : MOLECULAR BIOLOGY – I

#### Unit I:

Evidences for DNA as the vehicle of Inheritance – Griffith, McLeod, McCarty, Avery and Hershey-Chase experiments.

Definition of Gene, Chromosome, Nucleosome, Coding and Non-Coding

DNA in Prokaryotes and Eukaryotes – Unique, Moderately and highly Repetitive DNA Sequences

#### Unit II:

Mode of Replication – Conservative, Semi Conservative with experimental Proof and dispersive.

Enzymes involved in Replications – DNA polymerases, DNA Helicases, Topoisomerases, Ligases.

Primer, Okazaki fragments, Replication Fork and Replication Bubble.

Unidirectional, Bidirectional, Theta, and Rolling Circle mode of Replication

#### Unit III:

DNA Replication in Prokaryotes, Initiation, Elongation and Termination

#### Unit IV:

Molecular basis of Mutation – Cause of Mutation – Chemical and Physical Factors - Types of Mutation – Spontaneous and Induced – DNA repair System in E. Coli – Biochemistry of Cancer – Etiology, Carcinogens – Chemical, Oncogenic Viruses and anticancer drugs.

#### Unit V:

Recombinant DNA Technology – Role of Restriction Endonucleases, Vectors Involved in Cloning – Plasmid and Cosmid – Recombinant DNA Technology. (Outline Only)

#### BOOKS RECOMMENDED

1. A. Lehninger - Principles of Biochemistry.  
David L Nelson &

- Michael M Cox  
Third Edition (2002)  
Macmillan Work Publishers.
2. Harper's illustrated Biochemistry

Robert K Murray &

Daryl K Granner

26<sup>th</sup> International Edition,

(2003)

Mc Graw Hill

3. Biochemistry

Lubert Stryer

Fourth Edition

W H Freeman & Company., San  
Francisco

4. Molecular Biology

David Freifelder

Second Edition, (2003) Narosa Publishing  
House,

5. Gene VII

Benjamin Lewin (2000)

Oxford University Press, Mumbai

New Delhi

6. Molecular Cell Biology

Lodish, Berk & Baltimore  
Fourth Edition, (2000)

W H Freeman & Company, New  
York

7. Concepts In Biotechnology

First Edition, (1998)

D Balasubramanian &

CFA Bryce

University Press

8. Biological Science

Soper

Cambridge Low Price Edition,  
(2002)

9. Molecular Biology

TA Brown

## SEMESTER V

### **PAPER VIII : MOLECULAR BIOLOGY – II**

#### **Unit I:**

Prokaryote Transcription – RNA polymerase, Sub unit, Structure and Functions. Promoter Complexes, Transcription Initiation, Elongation and Termination

#### **Unit II**

Eukaryote RNA Polymerases 1, 2, 3 and their functions. Post

Transcriptional modification in Prokaryotes. Post Transcriptional Modification of mRNA, rRNA and tRNA. Inhibitors of Transcription.

#### **Unit III**

Genetic Code – Experimental Evidences, Basic feature of Genetic Code. Deciphering of Genetic Code, Wobble Hypothesis, Composition of Prokaryotic and Eukaryotic Ribosomes.

#### **Unit IV**

Protein Biosynthesis – Structure and Activation of Amino Acids. Initiation, Elongation and Termination of translation in Prokaryotes, Inhibitors of Translation.

#### **Unit V**

Regulation of Gene Expression in Prokaryotes. Operon Concept, Induction, Positive and Negative in Operon

### **BOOKS RECOMENDED**

1. Lehninger -Principles of Biochemistry.  
David L Nelson &  
Michael M Cox  
Third Edition (2002)

Macmillan Work Publishers

2. Harper's Illustrated Biochemistry

Robert K Murray &

Daryl K Granner

26<sup>th</sup> International Edition, (2003)

Mc Graw Hill

3. Biochemistry

Lubert Srtryer

Fourth Edition

W H Freeman & Company., San Francisco

4.Molecular Biology

David Freifelder

Second Edition, (2003)

Narosa Publishing House, New Delhi

5.Gene VII

Benjamin Lewin (2000)

Oxford University Press, Mumbai

6.Molecular Cell Biology

Lodish, Berk & Baltimore  
Fourth Edition, (2000)

W H Freeman & Company, New York

7.Text Book of Medical Biochemistry MN.

Chatterjea and Rane Shinde

6<sup>th</sup> Edition (2005)

Jaypee Publications Ltd., New Delhi

8.Molecular BiologyT A Brow

## **SEMESTER V**

### **PAPER IX : HUMAN PHYSIOLOGY**

#### **Unit I:**

Blood composition and function, types of blood cells, morphology and function. Blood groups – A, B, O and rhesus system. Composition and function of lymph and lymphatic system.

#### **Unit II:**

Excretory system – Overall design of urinary system – kidney structure and its organization. Mechanism of urine formation – Function of Glomerular filtration rate (GFR), selective reabsorption, active and passive transport of various substances and secretion.

#### **Unit III:**

Digestive Systems: Structure and function of different components of digestive system – Digestion and absorption of carbohydrates, lipids and proteins, role of bile salt in digestion and absorption, mechanism of HCl formation in stomach, role of various enzymes and hormones involved in digestive process.

#### **Unit IV:**

Brief outline of nervous system – Brain (parts and ventricles), spinal cord, nerve fibres, synapses, chemical and electrical synapses, nerve impulses, action potential and neuro transmitters

#### **Unit V:**

Muscles: Types of muscles and their functions: myofilamentation, contraction and relaxation of skeletal muscles. Outline of various components of respiratory system and gaseous exchange.

### **Books Recommended**

Text Book of Human Physiology  
Sarada Subramanyam & K. Madhavan Kutty  
Revised by H. D. Singh , (2004)  
S. Chand and Company Ltd.

Animal Physiology  
P.S.Verma, B.S.Tyagi & V.K.Agarwal  
3<sup>rd</sup> Edition (2000)  
S. Chand and Company Ltd.

Animal Physiology and Biochemistry  
R.A.Agarwal, Anil K.Srivastava, Kaushal Kumar  
S.Chand and Company Ltd, (1998)

1. Mc Naught & Collander's Illustrated Physiology by  
B.R.Mackenna & R.Collander  
6<sup>th</sup> Edition – Reprinted –(1997)  
Longman Singapore Publishers Pvt Ltd.