

## Common Framework of CBCS for Colleges in Andhra Pradesh

(A.P. State of Council of Higher Education)

### B.Sc., BIOCHEMISTRY

Course Structure, Scheme of Instruction and Examination, 2015

#### Semester Pattern

<b>SEMESTER - III</b>	<b>Marks</b>
<b>Theory –BCT-301: Enzymology and Bioenergetics</b>	<b>75</b>
Unit-I:Classification of Enzymes and Structure	
Unit-II: Influence of Physical factors and Inhibitors on Enzyme activity	
Unit- III: Mechanism of enzyme action	
Unit-IV: Bioenergetics	
Unit-V: Biological Oxidations in Mitochondria	
<b>Practical – BCP-301: Enzymology</b>	<b>50</b>
<b>SEMESTER- IV</b>	<b>Marks</b>
<b>Theory – BCT-401: Intermediary Metabolism</b>	<b>75</b>
Unit –I : Carbohydrates Metabolism	
Unit-II : Lipid Metabolism	
Unit-III : Metabolism of Amino acids	
Unit-IV : Nitrogen Fixation	
Unit-V: Metabolism of Nucleic acids and heme	
<b>Practical – BCP-401 : Quantitative Analysis</b>	<b>50</b>

## **B.Sc -BIOCHEMISTRY ( CBCS) SYLLABUS, 2015**

### **Semester III**

#### **Theory : BCT-301 Enzymology and Bioenergetics**

**60 hrs**  
**(5 periods/week)**

##### **Unit-I: Classification of Enzymes and Structure**

**12 hours**

Introduction to biocatalysis, differences between chemical and biological catalysis. Nomenclature and classification of enzymes. Enzyme specificity. Active site. Principles of energy of activation, transition state. Interaction between enzyme and substrate- lock and key, induced fit models. Definition of holo-enzyme, apo-enzyme, coenzyme, cofactor. Fundamentals of enzyme assay, enzyme units.

##### **Unit II: Influence of Physical factors and Inhibitors on Enzyme activity.**

**12 hours**

Factors affecting the catalysis- substrate concentration, *pH*, temperature. Michaelis - Menten equation for uni-substrate reaction (derivation not necessary), significance of  $K_M$  and  $V_{max}$ . Enzyme inhibition- irreversible and reversible, types of reversible inhibitions- competitive and non-competitive.

##### **Unit-III: Mechanism of enzyme action**

**12 hours**

Outline of mechanism of enzyme action- acid-base catalysis, covalent catalysis, electrostatic catalysis, and metal ion catalysis. Regulation of enzyme activity- allosterism and cooperativity, ATCase as an allosteric enzyme, covalent modulation- covalent phosphorylation of phosphorylase, zymogen activation- activation of trypsinogen and chymotrypsinogen. Isoenzymes (LDH). Multienzyme complexes (PDH). Ribozyme .

##### **Unit- IV: Bioenergetics**

**12 hours**

Bioenergetics: Thermodynamic principles – Chemical equilibria; free energy, enthalpy (H), entropy (S). Free energy change in biological transformations in living systems; High energy compounds. Energy, change, oxidation-reduction reactions.

##### **Unit V : Biological Oxidations in Mitochondria**

**12 hours**

Organization of electron carriers and enzymes in mitochondria. Classes of electron-transferring enzymes, inhibitors of electron transport. Oxidative phosphorylation. Uncouplers and inhibitors of oxidative phosphorylation. Mechanism of oxidative phosphorylation.

#### **Practical – BCP-301: Enzymology**

##### **List of Experiments:**

1. Assay of amylase
2. Assay of urease
3. Assay of catalase.
4. Assay of phosphatase
5. Determination of optimum temperature for amylase.
6. Determination of optimum *pH* for phosphatase.

**45 hrs**  
**(3 periods/week)**

**MODEL QUESTION PAPER FOR END SEMESTER EXAM**  
**B.Sc Degree Course**  
**(Semester-III) Enzymology and Bioenergetics**  
**B.Sc Biochemistry**

**Timer: 3hrs**

**Max marks: 75**

**Section-A (5X5=25 marks)**  
Attempt any **Five** of the following

1. Free energy.
2. Redox potential
3. Substrate level phosphorylation
4. Uncouplers.
5. Co-enzyme.
6. Enzyme specificity
7. Enzyme inhibition.
8. Isozymes.

**Section-B (10X5=50 marks)**  
Attempt all the following questions

9. List out high energy compounds and explain the reason for their energy rich nature.  
(OR)
10. Write short notes on
  - a) principles of thermodynamics.
  - b) Free energy change in biological transformation
11. Explain the organization of electron carriers in mitochondrial membrane.  
(OR)
12. Discuss the mechanism of oxidative phosphorylation.
13. Describe the IUB classification of enzymes.  
(OR)
14. How to assay the enzymes activity by spectroscopic methods.
15. What are the factors influence enzyme activity.  
(OR)
16. Explain the different types of enzyme inhibition.
17. Describe the mechanism of action of enzymes.  
(OR)
18. How the enzymes activities are regulated.

**Semester - IV**  
**Theory: BCT- 401 Intermediary Metabolism**

**60 hrs**  
**(5 periods/week)**

**Unit- I : Carbohydrate Metabolism**

**12 hours**

Concept of anabolism and catabolism. Glycolytic pathway, energy yield. Fate of pyruvate- formation of lactate and ethanol, Pasteur effect. Citric acid cycle, regulation, energy yield, amphipathic role. Anaplerotic reactions. Glycogenolysis and glycogenesis. Pentose phosphate pathway. Gluconeogenesis. Photosynthesis- Light and Dark reactions, Calvin cycle, C<sub>4</sub> Pathway. Disorders of carbohydrate metabolism- Diabetes Mellitus.

**Unit- II: Lipid Metabolism**

**12 hours**

Catabolism of fatty acids ( $\beta$ - oxidation) with even and odd number of carbon atoms, Ketogenesis, *de novo* synthesis of fatty acids, elongation of fatty acids in mitochondria and microsomes, Biosynthesis and degradation of triacylglycerol and lecithin. Biosynthesis of cholesterol. Disorders of lipid metabolism.

**Unit- III: Metabolism of Amino acids**

**12 hours**

General reactions of amino acid metabolism- transamination, decarboxylation and deamination, Urea cycle and regulation, Catabolism of carbon skeleton of amino acids- glycogenic and ketogenic amino acids. Metabolism of glycine, serine, aspartic acid, methionine, phenylalanine and leucine. Biosynthesis of creatine. Inborn errors of aromatic and branched chain amino acid metabolism.

**Unit- IV: Nitrogen Fixation**

**12 hours**

Nitrogen cycle, Non-biological and biological nitrogen fixation, Nitrogenase system. Utilization of nitrate ion, Ammonia incorporation into organic compounds. Synthesis of glutamine and regulatory mechanism of glutamine synthase.

**Unit- V: Metabolism of Nucleic acid and heme:**

**12 hours**

Biosynthesis and regulation of purine and pyrimidine nucleotides, *de novo* and salvage pathways. Catabolism of purines and pyrimidines. Biosynthesis of deoxyribonucleotides- ribonucleotide reductase and thymidylate synthase and their significance. Disorders of nucleotide metabolism- Gout, Lesch-Nyhan syndrome. Biosynthesis and degradation of heme.

**Practical – BCP-401: Quantitative Analysis**

**45 hrs**  
**(3 periods/week)**

**List of Experiments:**

1. Estimation of amino acid by Ninhydrin method.
2. Estimation of protein by Biuret method.
3. Estimation of protein by Lowry method.
4. Estimation of glucose by DNS method.
5. Estimation of glucose by Benedict's titrimetric method.
6. Estimation of total carbohydrates by Anthrone method.

**MODEL QUESTION PAPER FOR END SEMESTER EXAM**  
**B.Sc Degree Course**  
**(Semester-IV) Intermediary Metabolisms**

**B.Sc Biochemistry**

**Timer: 3hrs**

**Max marks: 75**

**Section-A (5X5=25 marks)**

Attempt any **Five** of the following

1. Nitrogen cycle
2. Utilisation of nitrate
3. Transamination.
4. Gout.
5. Pentose phosphate pathway.
6. C<sub>4</sub> pathway.
7. Ketogenesis.
8. Phenylketonuria.

**Section-B (10X5=50 marks)**

Attempt all the following questions

9. Explain the biochemical reactions in C<sub>3</sub> pathway.  
(OR)
10. How TCA cycle is considered as amphibolic pathway.
11. Explain the biochemical events in β-oxidation of fatty acids.  
(OR)
12. Describe the biosynthetic pathway of cholesterol.
  
13. What is the fate of aromatic aminoacids during catabolism.  
(OR)
14. Explain the biochemical steps involved in urea cycle.
15. Write an essay on the biological nitrogen fixation.  
(OR)
16. Steps involved in the synthesis and regulation of glutamine synthase.
17. Explain the biochemical reactions in purine nucleotides biosynthesis.  
(OR)
18. Write an essay on the disorders of nucleotide metabolism.