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

SEMESTER - II	**Marks**
Theory –BCT-201: Nucleic acids and Biochemical Techniques	**75**
Unit-I : Nucleic Acids	
Unit-II: Porphyrins	
Unit-III: Biochemical Techniques I	
Unit IV: Biochemical Techniques II	
Unit-V: Techniques employed in metabolic studies	
Practical – BCP-201 : Isolations and Biochemical Techniques	**50**
SEMESTER - III	**Marks**
Theory –BCT-301: Enzymology and Bioenergetics	**75**
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	
Practical – BCP-301: Enzymology	**50**
SEMESTER- IV	**Marks**
Theory – BCT-401: Intermediary Metabolism	**75**
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	
Practical – BCP-401 : Quantitative Analysis	**50**

3rd Year:

Semester-V: Skill Development Course-1 (University's Choice)

Skill Development Course- 2 (University's Choice)

Semester-II

60 hrs
(5 periods/week)

Theory: BCT-201 Nucleic acids and Biochemical Techniques

Unit-I : Nucleic Acids **12 hours**

Nature of nucleic acids. Structure of purines and pyrimidines, nucleosides, nucleotides. Stability and formation of phosphodiester linkages. Effect of acids, alkali and nucleases on DNA and RNA. Structure of Nucleic acids- Watson-Crick DNA double helix structure, introduction to circular DNA, super coiling, helix to random coil transition, denaturation of nucleic acids- hyperchromic effect, *T*m-values and their significance. Reassociation kinetics, cot curves and their significance. Types of RNA and DNA.

Unit-II: Porphyrins **9 hours**

Structure of porphyrins; Protoporphyrin, porphobilinogen properties Identification of Porphyrins. Structure of metalloporphyrins – Heme, cytochromes and chlorophylls.

Unit-III: Biochemical Techniques I **15 hours**

Methods of tissue homogenization: (Potter-Elvejham, mechnical blender, sonicator and enzymatic).
Principle and applications of centrifugation techniques- differential, density gradient. Ultra-centrifugation- preparative and analytical..
Principle and applications of chromatographic techniques- paper, thin layer, gel filtration, ion- exchange and affinity chromatography. Elementary treatment of an enzyme purification.
Electrophoresis- principles and applications of paper, polyacrylamide (native and SDS) and agarose gel electrophoresis.

Unit-IV: Biochemical Techniques II **12 hours**

Colorimetry and Spectrophotometry- Laws of light absorption- Beer-Lambert law. UV and visible absorption spectra, molar extinction coefficient, biochemical applications of spectrophotometer. Principle of fluorimetry.
Tracer techniques: Radio isotopes, units of radio activity, half life, β and γ- emitters, use of radioactive isotopes in biology.

Unit- V: Techniques employed in metabolic studies **12 hours**

Broad outlines of Intermediary metabolism, methods of investigation, Intermediary metabolism in vivo studies such as analysis of excretion, Respiratory exchange, Removal of organs and perfusion studies, in vitro studies such as tissue slice techniques; Homogenates and purified enzyme systems; isotope tracer studies, use of inhibitors and antimetabolites.

Practical BCP- 201 : Nucleic acids and Biochemical Techniques 45 hrs

List of Experiments: **(3 periods/week)**

1. Isolation of RNA and DNA from tissue/culture.
2. Qualitative Identification of DNA,RNA and Nitrogen Bases
3. Isolation of egg albumin from egg white.
4. Isolation of cholesterol from egg yolk.
5. Isolation of starch from potatoes.
6. Isolation of casein from milk.

7. Separation of amino acids by paper chromatography.
8. Determination of exchange capacity of resin by titrimetry.
9. Separation of serum proteins by paper electrophoresis.
10. Separation of plant pigments by TLC.

Semester III

60 hrs
(5 periods/week)

Theory : BCT-301 Enzymology and Bioenergetics

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, *p*H, 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 cooperatitvity, ATCase as an allosteric enzyme, covalent modulation- covalent phosphorylation of phosphorylase, zymogen activation- activation of trypsinogen and chymotrypsinogen. Isoenzymes (LDH). Multienzyme complxes (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, inhibiters of electron transport. Oxidative phosphorylation. Uncouplers and inhibitors of oxidative phosphorylation. Mechanism of oxidative phosphorylation.

Practical – BCP-301: Enzymology

List of Experiments:

45 hrs
(3 periods/week)

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 *p*H for phosphatase.

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. Photosytnthesis- Light and Dark reactions, Calvin cycle, C_4 Pathway. Disorders of carbohydrate metabolism- Diabetes Mellitus.

Unit- II: Lipid Metabolism **12 hours**

Catabolism of fatty acids (β- 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.