**Dr. V. S. KRISHNA GOVERNMENT DEGREE AND PG COLLEGE (A), VSKP**
**DEPARTMENT OF BIOTECHNOLOGY**
**II B.Sc BIOTECHNOLOGY SYLLABUS**
**SEMESTER III**

## Course III: BIOCHEMISTRY AND BIOPHYSICAL TECHNIQUES

(Total Hours of Teaching 60 @ 04 hrs/week)
Credits - 04

**Course Outcomes:**

On successful completion of this course, the students will have the knowledge and skill to:

- Explain and classify different types of biomolecules (Amino acids, proteins, carbohydrates, lipids and vitamins along with their significance
- Illustrate chemical structure of nitrogen bases, DNA and forces stabilizing the DNA
- Differentiate between different forms of DNA
- Explain enzymes with classification and nomenclature, enzyme kinetics and enzyme inhibition types along with significance.
- Explain various metabolic pathways with significance and regulation
- Differentiate absorption and emission spectra.
- Illustrate each region of electromagnetic spectrum for spectroscopy
- Explain and relate the concepts of radioactivity and its applications.
- Illustrate and differentiate blotting techniques along with their applications and significance
- Identify and differentiate working principle, instrumentation and applications of various bio-analytical instruments.

**MODULE I: Biomolecules 12 Hours**

1.1. Carbohydrates: Classification, structure and functions of monosaccharides, disaccharides and polysaccharides.
1.2. Amino acids: Properties, structure, types and classification, peptide bond formation
1.3. Proteins: Primary, secondary, tertiary and quaternary structures.
1.4. Lipids: Types of lipids, classification. Saturated and unsaturated fatty acids, triglycerides, and phospholipids; Acid value, saponification value and iodine value.

**MODULE II: Nucleic acids and Enzymes 12 Hours**

2.1. Nucleic acids: Chemical structure and base composition of nucleic acids, forces stabilizing nucleic acid structures; Chargaff's rules.
2.2. Watson Crick Model (B-DNA); Forms of DNA (A, B, Z). Structure of RNA (TMV).
2.3. Enzymes: Terminology; Nomenclature and classification;, substrate specificity, lock and key and Induced fit models.
2.4. Michaelis-Menton equation; Factors affecting enzyme reactions; Enzyme inhibition kinetics (reversible inhibition types – competitive, uncompetitive and non-competitive) and irreversible reactions.

**MODULE III: Bioenergetics and Metabolisms 12**

**Hours**

3.1 Concept of free energy, Entropy, Enthalpy & Redox Potential. Concept of high energy bonds as related to the structure of ATP, Phosphoenolpyruvate, Creatine phosphate.

3.2. Pathways and significance of Glycolysis; Gluconeogenesis: Bypass reactions.

3.3. TCA cycle; Urea Cycle; Glyoxylate cycle

3.4. Electron transport chain and Oxidative phosphorylation; B oxidation of fatty acids

**MODULE IV: Spectrophotometry and Chromatography 12 Hours**

4.1. Spectrophotometry: Principle, instrumentation and applications

4.2. Chromatography: Partition principle, partition coefficient, nature of partition forces, brief account of paper chromatography. Thin layer chromatography and column chromatography.

4.3. Gel filtration: Concept of distribution coefficient, types of gels and glass beads, applications. Ion-exchange chromatography and Affinity chromatography

4.4. Electrophoresis: Migration of ions in electric field, factors affecting electrophoretic mobility. Paper electrophoresis and Gel electrophoresis: - Types of gels. SDS-PAGE Electrophoresis and applications

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**MODULE V: Centrifugation Techniques 12 Hours**

5.1. Centrifugation: Basic principles, the concept of RCF,

5.2. Types of centrifuges (clinical, high speed and ultracentrifuges).

5.3.Preparative centrifugation: Differential and density gradient centrifugation, applications (Isolation of cell components)

5.4. Analytical centrifugation: Sedimentation coefficient, determination of molecular weight by sedimentation velocity.

## PRACTICALS

### Course III – BIOCHEMISTRY AND BIOPHYSICAL TECHNIQUES
### (Total hours of Laboratory Exercises – 30 hours @ 03 hrs/week)
### Credits - 02

**Course Outcomes:**

On successful completion of this practical course, the students have the knowledge and skills to:

- Qualitatively and quantitatively estimate carbohydrates with clear graphical representation along with calculation.
- Estimate DNA, RNA and Proteins with graphical representation
- Demonstrate enzyme immobilization by gel entrapment method.
- Paper chromatography, agarose gel electrophoresis and SDS-PAGE.
- Analyse DNA denaturation
- Determine the amino acids and sugars present in the given samples chromatographically.
- Perform the electrophoresis of proteins

**Practical Syllabus**

1. Qualitative estimation of Carbohydrates.
2. Estimation of glucose by Benedict's quantitative method.
3. Estimation of DNA by Diphenylamine method.
4. Estimation of RNA by Orcinol method.
5. Quantitative Estimation of proteins by Biuret method.
6. Immobilization of enzymes / cells by entrapment in alginate gel.
7. Spectrophotometric analysis of DNA denaturation.
8. Paper chromatography of amino acids/sugars.
9. Gel electrophoresis of proteins.
10. SDS-PAGE of an oligometric protein.