Bharatiya Vidya Bhavan

BHAVAN'S VIVEKANANDA COLLEGE

OF SCIENCE, HUMANITIES & COMMERCE
Sainikpuri, Secunderabad – 500094
Reaccredited with 'A' grade by NAAC
Autonomous College - Affiliated to Osmania University

Department of Biochemistry & Nutrition

Template for B. Sc BIOCHEMISTRY under CBCS
PROGRAM NAME: BCNDC (BIOCHEMISTRY, NUTRITION & DIETETICS, CHEMISTRY)
Academic year 2025-26

FIRST YEAR – SEMESTER-I				
Course Code	**Course title**	**Course Type**	**HPW**	**CREDITS**
	Environmental Science/Computer Skills	AECC-1	2	2
	English	CC-1A	4	4
	Second Language	CC-2A	4	4
BC134/ BC134 P	**Chemistry of Biomolecules**	**DSC-1A**	**4T+2P=6**	**4+1=5**
	Optional 2	DSC-2A	4T+2P=6	4+1=5
	Optional 3	DSC-3A	4T+2P=6	4+1=5
	TOTAL		**28**	**25**
SEMESTER-II				
	Environmental Science/Computer Skills	AECC-2	2	2
	English	CC-1B	4	4
	Second Language	CC-2B	4	4
BC234/ BC234 P	**Chemistry of Proteins, Nucleic acids and Bioenergetics**	**DSC-1B**	**4T+2P=6**	**4+1=5**
	Optional 2	DSC-2B	4T+2P=6	4+1=5
	Optional 3	DSC-3B	4T+2P=6	4+1=5
	TOTAL		**28**	**25**
SECOND YEAR –SEMESTER-III				
	English	CC-1C	3	3
	Second Language	CC-2C	3	3
BC334/ BC334 P	**Enzymology and Metabolism of Carbohydrates and Lipids**	**DSC-1C**	**4T+2P=6**	**4+1=5**
	Optional 2	DSC-2C	4T+2P=6	4+1=5
	Optional 3	DSC-3C	4T+2P=6	4+1=5
	Communicative Skills	**SEC 1**	**2**	**2**
SE334	**Basics in Biochemical calculations and Biostatistics**	**SEC 2**	**2**	**2**
	TOTAL		**28**	**25**

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SEMESTER-IV				
	English	CC-1D	3	3
	Second Language	CC-2D	3	3
BC434/ BC434 P	**Biochemical techniques and Metabolism of Amino acids and Nucleotides**	**DSC-1D**	**4T+2P=6**	**4+1=5**
	Optional 2	DSC-2D	4T+2P=6	4+1=5
	Optional 3	DSC-3D	4T+2P=6	4+1=5
	Universal Human Values	**SEC-3**	**2**	**2**
SE434	**Clinical Laboratory Diagnostics**	**SEC-4**	**2**	**2**
	TOTAL		**28**	**25**
THIRD YEAR –SEMESTER-V				
	English	CC-1E	3	3
	Second Language	CC-2E	3	3
BC534/ BC534 P **BC534A/ BC534A P**	**A. Physiologyand Clinical Biochemistry** **(or)** **B. Microbiology, Genetics and rDNA technology**	**DSE-1E**	**4T+2P=6**	**4+1=5**
	Optional 2	DSE-2E	4T+2P=6	4+1=5
	Optional 3	DSE-3E	4T+2P=6	4+1=5
GE534	**Biochemistry and Physiology**	**GE**	**4T**	**4**
	TOTAL		**28**	**25**
SEMESTER-VI				
	English	CC-1F	3	3
	Second Language	CC-2F	3	3
BC634/ BC634 P **BC634A/ BC634A P**	**A. Molecular Biology and Immunology** **(or)** **B. Cell Biology and Biotechnology**	**DSE-1F**	**4T+2P=6**	**4+1=5**
	Optional 2	DSE-2F	4T+2P=6	4+1=5
	Optional 3	DSE-3F	4T+2P=6	4+1=5
BC634_O BC634_PW	**Optional Paper Theory – Biochemistry in health and Disease / Project Work**		**4**	**4**
	TOTAL		**28**	**25**
	TOTAL CREDITS			**150**

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PROGRAM NAME: BCNDC (BIOCHEMISTRY, NUTRITION & DIETETICS, CHEMISTRY)

COURSE NAME: CHEMISTRY OF BIOMOLECULES

PAPER CODE: BC134 **PPW: 4**
YEAR/SEMESTER: I/I **NO. OF CREDITS: 4**

COURSE OBJECTIVE: To familiarize the students with the basic classification and identification of different biomolecules.

UNIT-WISE COURSE OBJECTIVES:

COb1 To explain the molecular architecture of prokaryotic and eukaryotic cells.
COb2 To discuss classification of amino acids and properties of proteins.
COb3 To discuss the classification of sugars and their chemical reactions.
COb4 To explain the classification of fats.

UNIT I: - Introduction to molecules of life	**15 hrs**
Origin of life- chemical evolution and rise of living systems.	1hr
Water as a biological solvent and its role in biological processes.	1hr
pH, Buffers, Henderson- Hasselbalch equation.	2hrs
Acid-base and electrolyte balance in the body.	2hrs
Structure and classification of prokaryotes.	1hr
Sterilization methods and isolation ofpure cultures.	2hrs
Metabolic energy sources employed by prokaryotes.	1hr
Structure and function of eukaryotic cell (plant and animal cell).	2hrs
Phylogenetic classification and differentiation of eukaryotic cell.	2hrs
Biological structures and metabolic processes in cell.	1hr

UNIT II: - Amino acids and peptides	**15 hrs**
Amino acids: Classification, structure, stereochemistry.	3hrs
Chemical reactions of amino acids due to carboxyl and amino groups.	3hrs
Titration curve of glycine and p*Ka* values.	2hrs
Essential and non-essential amino acids.	1hr
Unusual amino acids.	1hr
Peptide bond – nature, Types of conformations.	3hrs
Biologically active peptides and polypeptides.	2hrs

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UNIT III: - Carbohydrates **15hrs**

Classification, monosaccharides, D and L designation, open chain and cyclic structures, epimers and anomers, mutarotation. 4hrs

Reactions of carbohydrates (due to functional groups-hydroxyl, aldehyde and ketone) 2hrs

Amino sugars, Glycosides. 1hr

Structure and biological importance of disaccharides (sucrose, lactose, maltose, isomaltose, trehalose), trisaccharide's (raffinose, melezitose), structural polysaccharides (cellulose, chitin, pectin) and storage polysaccharides (starch, inulin, glycogen). 4hrs

Glycosaminoglycans, Bacterial cell wall polysaccharides. 2hrs

Outlines of glycoproteins, glycolipids and blood group substances. 2hrs

UNIT IV: - Lipids **15hrs**

Lipids: Classification, saturated and unsaturated fatty acids. 2hrs

Structure and properties of fats and oils. 1hr

Acid value, saponification and iodine values, rancidity. 2hrs

General properties and structures of phospholipids and sphingolipids. 2hrs

Cholesterol- structure and properties. 1hr

Lipoproteins: Types and functions. 2hrs

Properties of lipid aggregates – micelles, bilayers. Liposomes 2hrs

Composition and architecture of membranes. 1hr

Fundamental properties of biological membranes. 1hr

Experimental proof for fluidity and dynamic properties. 1hr

REFERENCES:

1. Lehninger, Principles of Biochemistry, David L. Nelson, Michael M. Cox Publisher: W. H. Freeman.
2. Biochemistry, 4th Edition- Donald Voet, Judith G. Voet. - Publisher John Wiley & Sons.
3. Outlines of Biochemistry- Conn. E. E., Stumpf. P.K., Bruening, G and Doi. R.H., John Wiley & Sons.
4. Biochemistry- Satyanarayana. U and Chakrapani. U, Books & Allied Pvt. Ltd.
5. Textbook of Biochemistry – West. E.S., Todd. W. R, Mason. H.S., and Bruggen, J.T.V., Oxford & IBH.

COURSE OUTCOMES:

At the end of the course students will be able to:

BC134.CO1 Compare the organization of prokaryotic cell to eukaryotic cell.

BC134.CO2 Differentiate the amino acids based on their side chains.

BC134.CO3 Distinguish between the simple and complex sugars.

BC134.CO4 Relate the different types of fats and their importance in cellular architecture.

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PROGRAM NAME: BCNDC (BIOCHEMISTRY, NUTRITION & DIETETICS, CHEMISTRY)
COURSE NAME: QUALITATIVE ANALYSIS OF BIOMOLECULES

PAPER CODE: BC134P **PPW: 2**
YEAR/SEMESTER: I/I **NO. OF CREDITS: 1**

COURSE OBJECTIVES:

COb1 To inculcate good laboratory practices and laboratory hygiene.

COb2 To learn preparation of standard solutions and buffers and identify the biomolecules qualitatively. To learn preparation and sterilization of culture media to isolate microorganisms.

1. Introduction to Good Laboratory Practices (GLP). Principles of Laboratory Hygiene and Safety.
2. Preparation of standard solutions. Molarity, Normality, percentage solutions.
3. Preparation of buffers (acidic, neutral and alkaline) and determination of pH. Calibration of pH meter.
4. Titration curve of glycine and determination of *p*K and *p*I values.
5. Qualitative identification of carbohydrates - glucose, fructose, ribose/xylose, maltose, sucrose, lactose, starch/glycogen.
6. Preparation of Osazones and their identification.
7. Qualitative identification of amino acids - histidine, tyrosine, tryptophan, cysteine, arginine.
8. Qualitative identification of lipids - solubility, saponification, acrolein test, Salkowski test. Test for unsaturation – Hubl's iodine test, Bromine decolourisation test.
9. Preparation ofculture media and sterilization.
10. Isolation of pure cultures.

REFERENCES:

1. Experimental Biochemistry-A student companion-Beedu Sashidhar Rao and Vijay Deshpande.
2. Laboratory Manual in Biochemistry- Jayaraman, J. Wiley Eastern

COURSE OUTCOMES:

At the end of the course students will be able to:

BC134P.CO1 Gain knowledge in understanding laboratory safety and implementing routine practice.

BC134P.CO2 Prepare various buffers and solutions and perform qualitative tests to identify biomolecules in different sources and also apply the knowledge in preparation ofculture media, Sterilization methods and isolation ofpure cultures.

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PROGRAM NAME: BCNDC (BIOCHEMISTRY, NUTRITION & DIETETICS, CHEMISTRY)

COURSE NAME: CHEMISTRY OF PROTEINS, NUCLEIC ACIDS AND BIOENERGETICS

PAPER CODE: BC234 **PPW:4**
YEAR/SEMESTER: I/II **NO OF CREDITS:4**

COURSE OBJECTIVE: To familiarize the students with the structural features of proteins, nucleic acids and basic concepts of Bioenergetics.

UNIT-WISE COURSE OBJECTIVES:

COb1 To understand the structural hierarchy of proteins.
COb2 To discuss the structure and properties of nucleic acids.
COb3 To explain the energy transformation reactions in biological systems.
COb4 To describe the organization of ETC complexes.

UNIT I: - Proteins	**15hrs**
Proteins classification based on solubility, shape and functions.	3hrs
Determination of amino acid composition of proteins.	2hrs
General properties of proteins.	2hrs
Denaturation and renaturation of proteins.	1hr
Structural organization of proteins- primary structure, secondary structure, tertiary and quaternary structures (eg, hemoglobin and myoglobin).	4hrs
Forces stabilizing the structure of proteins.	1hr
Strategies of protein sequencing.	2hrs

UNIT II: - Nucleic Acids	**15hrs**
Nature of nucleic acids, Structure of purines, pyrimidines, nucleosides, nucleotides.	3hrs
Stability and formation of phosphodiester linkages.	1hr
Effect of acids, alkali and nucleases on DNA and RNA.	1hr
Experiments showing DNA as store of genetic information.	2hrs
Structure of Nucleic acids - Watson-Crick DNA double helix structure.	1hr
Types of DNA/RNA.	2hrs
Structural variations of DNA/RNA - Palindromes, mirror repeats, hairpin and cruciform.	1hr
Introduction to circular DNA, super coiling.	1hr

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Helix to random coil transition. Denaturation and renaturation of nucleic acids.
Hyperchromic effect, Tm values and their significance. 1hr
Re-association kinetics, cot curves and their significance. 1hr
Additional functions of nucleotides – energy carriers, as components of enzyme cofactors 1hr

UNIT III: - Bioenergetics -I **15 hrs**
Energy transformations in the living system. 1hr
Enthalpy, entropy and Gibb's free energy. 2hrs
Reduction potentials. 2hrs
Free energy concept. Exergonic and endergonic reactions. 2hrs
High energy compounds. 2hrs
Role of ATP in biological systems. 1hr
Inorganic phosphate- phosphate group donor. 1hr
Phosphate group transfer potential. Substrate level phosphorylation. 2hrs
Cytochromes-structure, types and their functions. 2hrs

UNIT IV: - Bioenergetics- II **15hrs**
Biological oxidations: Definition, enzymes involved- oxidases, dehydrogenases and oxygenases. Redox reactions. 3hrs
Ultra-structure of mitochondria. Electron transport chain and carriers involved. 3hrs
Coenzymes and proteins as electron carriers. 2hrs
Oxidative phosphorylation, theories of oxidative phosphorylation- Mitchell's chemiosmotic theory, $F_o F_1$- ATPase. 3hrs
Inhibitors of respiratory chain and oxidative phosphorylation, Uncouplers. 2hrs
Formation of reactive oxygen species and their disposal through enzymatic reactions. 2hrs

REFERENCES:

1. Lehninger, Principles of Biochemistry, David L. Nelson, Michael M. Cox Publisher: W.H. Freeman
2. Biochemistry, 4th Edition- Donald Voet, Judith G. Voet. - Publisher John Wiley & Sons.
3. Biochemistry- Satyanarayana U and Chakrapani. U, Books & Allied Pvt. Ltd.

COURSE OUTCOMES:

At the end of the course students will be able to:

BC234.CO1 Relate to the structural organization of proteins to their functions.
BC234.CO2 Distinguish the structural features and properties of nucleic acids.
BC234.CO3 Interpret the concepts of biological oxidation and energy production.
BC234.CO4 Demonstrate the organization of ETC complexes.

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PROGRAM NAME: BCNDC (BIOCHEMISTRY, NUTRITION & DIETETICS, CHEMISTRY)
COURSE NAME: BIOCHEMICAL PREPARATIONS

PAPER CODE: BC234P **PPW: 2**
YEAR/SEMESTER: I/II **NO. OF CREDITS: 1**

COURSE OBJECTIVES:

COb1 To understand the concept of absorption maxima of coloured and colourless solutions.
COb2 To isolate and identify macromolecules from natural sources.

1. Absorption maxima of colored substances- *p*-Nitrophenol, Methyl orange and $KMnO_4$.
2. Absorption spectra of protein-BSA, nucleic acids- Calf thymus DNA.
3. Isolation and identification of cholesterol from egg yolk.
4. Isolation of lipids from biological samples.
5. Isolation and identification of lecithin from egg yolk.
6. Isolation and identification of starch from potato.
7. Isolation and identification of albumin from egg white.
8. Isolation and identification of casein from milk.
9. Isolation and identification of glycogen from liver.
10. Quantitation of glycine by formol titration method.

REFERENCES:

1. Experimental Biochemistry-A student companion-Beedu Sashidhar Rao and Vijay Deshpande.
2. Laboratory Manual in Biochemistry- Jayaraman, J. Wiley Eastern

COURSE OUTCOMES:

At the end of the course students will be able to:

BC234P.CO1 Analyse the presence of compounds based on its absorption maxima.
BC234P.CO2 Apply different isolation methods for various biomolecules from their natural sources.

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