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)
(Batch 2022-23 to 2024-25)

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+3P=7**	**4+1=5**
	Optional 2	DSC-2A	4T+3P=7	4+1=5
	Optional 3	DSC-3A	4T+3P=7	4+1=5
	TOTAL		**31**	**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+3P=7**	**4+1=5**
	Optional 2	DSC-2B	4T+3P=7	4+1=5
	Optional 3	DSC-3B	4T+3P=7	4+1=5
	TOTAL		**31**	**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+3P=7**	**4+1=5**
	Optional 2	DSC-2C	4T+3P=7	4+1=5
	Optional 3	DSC-3C	4T+3P=7	4+1=5
	Communicative Skills	**SEC 1**	**2**	**2**
SE334	**Basics in Biochemical calculations**	**SEC 2**	**2**	**2**

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	and Biostatistics			
	TOTAL		**31**	**25**
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+3P=7**	**4+1=5**
	Optional 2	DSC-2D	4T+3P=7	4+1=5
	Optional 3	DSC-3D	4T+3P=7	4+1=5
	Universal Human Values	**SEC-3**	**2**	**2**
SE434	**Clinical Laboratory Diagnostics**	**SEC-4**	**2**	**2**
	TOTAL		**31**	**25**
THIRD YEAR –SEMESTER-V				
	English	CC-1E	3	3
	Second Language	CC-2E	3	3
BC534/ BC534 P **BC534A/ BC534A P**	**A. Physiology, Nutrition and Clinical Biochemistry** **(or)** **B. Microbiology, Genetics and rDNA technology**	**DSE-1E**	**4T+3P=7**	**4+1=5**
	Optional 2	DSE-2E	4T+3P=7	4+1=5
	Optional 3	DSE-3E	4T+3P=7	4+1=5
GE534	**Biochemistry and Physiology**	**GE**	**4T**	**4**
	TOTAL		**31**	**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+3P=7**	**4+1=5**
	Optional 2	DSE-2F	4T+3P=7	4+1=5
	Optional 3	DSE-3F	4T+3P=7	4+1=5
BC634_O BC634_PW	**Optional Paper Theory – Biochemistry in health and Disease / Project Work**		**4**	**4**
	TOTAL		**31**	**25**
	TOTAL CREDITS			**150**

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PROGRAM NAME: B. Sc. (MICROBIOLOGY, BIOCHEMISTRY, CHEMISTRY- MBBCC)
(w.e.f 2022-23)

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.	2hrs
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.	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: B. Sc. (MICROBIOLOGY, BIOCHEMISTRY, CHEMISTRY-MBBCC)
(w.e.f 2022-23)

COURSE NAME: QUALITATIVE ANALYSIS OF BIOMOLECULES

PAPER CODE: BC134 P **PPW: 3**
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.

1. Introduction to Good Laboratory Practices (GLP).

2. Principles of Laboratory Hygiene and Safety.

3. Preparation of standard solutions. Molarity, Normality, percentage solutions.

4. Preparation of buffers (acidic, neutral and alkaline) and determination of pH. Calibration of pH meter.

5. Titration curve of glycine and determination of *p*K and *p*I values.

6. Qualitative identification of carbohydrates - glucose, fructose, ribose/xylose, maltose, sucrose, lactose, starch/glycogen.

7. Preparation of Osazones and their identification.

8. Qualitative identification of amino acids - histidine, tyrosine, tryptophan, cysteine, arginine.

9. Qualitative identification of lipids - solubility, saponification, acrolein test, Salkowski test.

10. Test for unsaturation – Hubl's iodine test, Bromine decolourisation test.

REFERENCES:

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

COURSE OUTCOMES:

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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.

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PROGRAM NAME: B. Sc. (MICROBIOLOGY, BIOCHEMISTRY, CHEMISTRY-MBBCC)
(w.e.f 2022-23)

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: B. Sc. (MICROBIOLOGY, BIOCHEMISTRY, CHEMISTRY-MBBCC)
(w.e.f 2022-23)

COURSE NAME: BIOCHEMICAL PREPARATIONS

PAPER CODE: BC234 P **PPW: 3**
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 starch from potato.
6. Isolation and identification of albumin from egg white.
7. Isolation and identification of casein from milk.
8. Isolation and identification of glycogen from liver.
9. 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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(Academic year 2023-24)

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

COURSE NAME: ENZYMOLOGY AND METABOLISM OF CARBOHYDRATES AND LIPIDS

PAPER CODE: BC334 **PPW: 4**
YEAR/SEMESTER: II/III **NO.OF CREDITS: 4**

COURSE OBJECTIVE: To familiarize students with nature, kinetics and different regulatory mechanisms of enzymes and to describe the metabolism and regulation of carbohydrates and lipids.

UNIT-WISE COURSE OBJECTIVES:

COb1 To discuss the nature of enzymes, factors affecting enzyme activity and basics of enzyme kinetics.
COb2 To outline the concept of enzyme catalysis and regulation with examples.
COb3 To describe about carbohydrate metabolism in plants and animals.
COb4 To explain the significance of lipid metabolism.

Unit I: - Enzymes	**15 hrs**
Introduction to biocatalysis, differences between chemical and biological catalysis.	1hr
Nomenclature and classification of enzymes.	2hrs
Enzyme specificity. Active site.	1hr
Principles of energy of activation, transition state.	2hrs
Definition of holo-enzyme, apo-enzyme, coenzyme, cofactor.	1hr
Fundamentals of enzyme assay, enzyme units.	1hr
Factors affecting the catalysis - substrate concentration, *p*H, temperature.	2hrs
Michaelis-Menten equation for uni-substrate reaction (derivation not necessary), Lineweaver- Burke plot, Significance of K_m and V_{max}.	2hrs
Enzyme inhibition- irreversible and reversible, types of reversible inhibitions - competitive, non-competitive and uncompetitive.	3hrs

Unit-II: - Enzyme Catalysis	**15 hrs**
Mechanism of enzyme action with examples - acid-base catalysis, covalent catalysis, electrostatic catalysis, and metal ion catalysis.	4hrs
Regulation of enzyme activity- allosterism and co-operativity, Glutamine synthetase as an allosteric enzyme.	3hrs
Covalent modulation - covalent phosphorylation of phosphorylase.	1hr
Zymogen activation- activation of trypsinogen and chymotrypsinogen.	1hr
Isoenzymes (CK, LDH) and Ribozyme.	2hrs
Multi enzyme complexes (PDH).	1hr

Immobilized enzymes.	2hrs
Catalytic antibodies.	1hr

Unit III: - Carbohydrate Metabolism	**15 hrs**
Concept of anabolism and catabolism.	1hr
Glycolytic pathway, energy yield, Fate of pyruvate - formation of lactate and ethanol, Pasteur effect.	3hrs
Citric acid cycle, regulation, energy yield, amphipathic role.	2hrs
Anaplerotic reactions.	1hr
Glycogenolysis and glycogenesis.	2hrs
Pentose phosphate pathway.	2hrs
Gluconeogenesis.	1hr
Photosynthesis - Light and Dark reactions, Calvin cycle, C4 Pathway.	3hrs

Unit IV: - Lipid Metabolism	**15 hrs**
Catabolism of fatty acids (β- oxidation) with even numbers.	2hrs
Catabolism of fatty acids with odd number of carbon atoms.	1hr
Ketogenesis.	1hr
de novo synthesis of fatty acids, elongation of fatty acids in mitochondria and microsomes	3hrs
Biosynthesis and degradation of triacylglycerol.	2hrs
Biosynthesis and degradation of lecithin.	1hr
Biosynthesis and regulation of cholesterol metabolism.	2hrs
Role of HDL, LDL, and Very-low-density lipoprotein (VLDL) and cholesterol levels in body.	3hrs

REFERENCES:

1. Lehninger, Principles of Biochemistry, David L. Nelson, Michael M. Cox Publisher: W.H. Freeman.
2. Biochemistry- Satyanarayana. U and Chakrapani. U, Books & Allied Pvt. Ltd.
3. Principles of Biochemistry: General Aspects- Smith, E. L., Hill, R.L. Lehman, I.R. Lefkowitz, R. J. Handler, P., and White, A. McGraw- Hill.

COURSE OUTCOMES:

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

BC334.CO1 Interpret the significance and role of enzymes in a living cell.
BC334.CO2 Correlate the function of enzymes with cellular homeostasis.
BC334.CO3 Relate the metabolic events of carbohydrates in conversion of food to energy to run cellular processes.
BC334.CO4 Illustrate the pathways of lipid metabolism and their significance in energy production.

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

COURSE NAME: QUANTITATIVE ANALYSIS & ENZYMOLOGY

PAPER CODE: BC334P **PPW: 3**
YEAR/SEMESTER: II/III **NO.OF CREDITS: 1**

COURSE OBJECTIVES

COb1 To understand the different quantitative methods for sugars.
COb2 To learn the steps in isolation, assay procedures and effect of physical factors on enzyme activity.

1. Estimation of reducing sugars by DNS method.
2. Estimation of total sugars by Anthrone method.
3. Estimation of Fructose by Roe's resorcinol method.
4. Analysis of Honey sample for total, reducing and non-reducing sugars.
5. Determination of achromic point of salivary α-amylase.
6. Assay of β-amylase from sweet potato.
7. Comparison of catalase activity in germinating seeds
8. Assay of acid and alkaline phosphatases from biological samples.
9. Determination of optimum temperature for amylase.
10. Determination of optimum pH for phosphatase.

REFERENCES:
1. Experimental Biochemistry-A student companion-Beedu Sashidhar Rao and Vijay Deshpande.
2. Enzyme Assays- A practical Approach: Eisenthal, R and Dawson, M. l., IRL Press.
3. Biochemical Methods- Sadasivam, S and Manickam, A. New Age International Publishers.

COURSE OUTCOMES:

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

BC334P.CO1 Implement the knowledge in carbohydrate analysis of various biological samples.
BC334P.CO2 Apply the assay methods to determine enzyme activity in various sources.

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COURSE NAME: BASICS IN BIOCHEMICAL CALCULATIONS AND BIOSTATISTICS

PAPER CODE: SE334 **PPW: 2**
YEAR/SEMESTER: II/III **NO.OF CREDITS: 2**

COURSE OBJECTIVE: To familiarize the students on the concept of biochemical calculations and biostatistics.

UNIT-WISE COURSE OBJECTIVES:

COb1 To explain the principles in basic biochemical calculations.
COb2 To train the students in various biostatistical methods.

Unit I: Basic Biochemical Calculations **15 hrs**

1. Units and measurements
2. Concentration of analyte: Mole, Molarity, Normality and Percent solutions
3. Concept of density and specific gravity
4. Enzyme activity, Specific activity and purity index
5. pH scale and measurement of redox potential
6. Concept of buffers and Buffer preparations
7. Construction of calibration Curve and absorption curve (λ max)

Unit II: Biostatistics **15 hrs**

1. Basic statistical concepts: Population, sampling and variables
2. Biostatistics: Measures of central tendency (Mean, Median, Mode)
3. Measurement of dispersion: Standard deviation, standard error, Spread sheets
4. Depiction of data by graphical methods
5. t-Test
6. Regression and Correlation, precision and accuracy
7. ANOVA

References:

1. Experimental Biochemistry-A student companion-Beedu Sashidhar Rao and Vijay Deshpande.
2. Laboratory Manual in Biochemistry- Jayaraman, J. Wiley Eastern
3. Enzyme Assays- A practical Approach: Eisenthal, R and Dawson, M. l., IRI. Press.
4. Biostatistics — Arora &Malhan, Himalaya Publishing House.

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COURSE OUTCOMES:

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

SE334.CO1 Apply the biochemical calculations in project or research work.
SE334.CO2 Implement the various statistical methods to analyse and interpret the data statistically in research and pharma industries.

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

COURSE NAME: BIOCHEMICAL TECHNIQUES AND METABOLISM OF AMINO ACIDS AND NUCLEOTIDES

PAPER CODE: BC434 **PPW: 4**
YEAR/SEMESTER: II/IV **NO.OF CREDITS: 4**

COURSE OBJECTIVE: To illustrate the significance of metabolic pathways of amino acids and nucleotides and to discuss the principle, instrumentation and applications of various biochemical techniques.

UNIT-WISE COURSE OBJECTIVES:

COb1 To discuss the metabolism of amino acids and related genetic defects.
COb2 To explain the metabolic pathways of nucleotides in relation to genetic defects.
COb3 To discuss the principle and applications of centrifugation and chromatography techniques.
COb4 To explain the principle and applications of electrophoresis, photometric methods and radioisotopes.

Unit I: - Amino Acid Metabolism	**15hrs**
General reactions of amino acid metabolism- transamination, decarboxylation & deamination.	2hrs
Urea cycle and its regulation.	2hrs
Catabolism of carbon skeleton of amino acids- glycogenic and ketogenic amino acids.	2hrs
Metabolism of Glycine, Serine, Aspartic acid and Methionine.	2hrs
Metabolism of Phenylalanine and Leucine.	3hrs
Biosynthesis of creatine.	1hr
Nitrogen cycle - Biological nitrogen fixation.	2hrs
Inborn errors of aromatic and branched chain amino acid metabolism.	1hr

Unit II: - Nucleotide Metabolism	**15hrs**
Biosynthesis and regulation of purine nucleotides *(de novo* and Salvage pathways).	2hrs
Biosynthesis and regulation pyrimidine nucleotides (*de novo* and Salvage pathways).	2hrs
Allosteric regulation of Aspartate Transcarbamoylase (ATCase).	1hr
Catabolism of Purines and Pyrimidines.	3hrs
Biosynthesis of deoxyribonucleotides- Ribonucleotide reductase.	2hrs
Thymidylate synthase and its significance.	1hr
Disorders of nucleotide metabolism- Gout, Lesch- Nyhan syndrome.	1hr
Biosynthesis and degradation of Heme and Porphyrins.	3hrs

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Unit III: - Biochemical Techniques – I **15hrs**

Methods of tissue homogenization (Potter-Elvejham, mechanical blender, sonicator& enzymatic).	1hr
Principle and applications of centrifugation techniques- differential, density gradient.	2hrs
Ultra-centrifugation- preparative and analytical.	3hrs
Principles and applications of – paper & thin layer chromatographic techniques.	1hr
Principle and applications of gel filtration chromatography.	2hrs
Principle and applications of ion- exchange chromatography.	2hrs
Principle and applications of affinity chromatography.	2hrs
Peptide sequencing and mapping.	2hrs

Unit IV: - Biochemical Techniques - II **15 hrs**

Electrophoresis - principle and applications of paper, polyacrylamide (native and SDS).	2hrs
Principle and applications of agarose gel electrophoresis.	2hrs
Principle of Isoelectric focusing.	1hr
Colorimetry and Spectrophotometry – Laws of light absorption - Beer-Lambert's law, UV and visible absorption spectra, molar extinction coefficient.	3hrs
Biochemical applications of spectrophotometer.	3hrs
Principle of fluorimetry.	1hr
Tracer techniques: Radioisotopes, units of radio activity, half-life, β and γ- emitters.	1hr
Use of radioactive isotopes in biology. Principle of autoradiography.	2hrs

REFERENCES:

1. Principles and techniques of practical Biochemistry- Wilson, K and Walker, J. Cambridge Press.
2. The Tools of Biochemistry- Cooper, T.G. John Wiley & Sons Press.
3. Physical Biochemistry- Friefelder, D. W. H. Freeman Press.
4. Analytical Biochemistry- Holme. D.J. and Peck. H., Longman.
5. Biophysical Chemistry: Principles and Techniques –Upadhyay A., Upadhyay K and Nath. Himalaya Publishing House.
6. Lehninger Principles of Biochemistry, David L. Nelson, Michael M. Cox Publisher: W.H. Freeman

COURSE OUTCOMES:

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

BC434.CO1 Relate the metabolic pathways of amino acids to various cellular functions.
BC434.CO2 Correlate metabolic pathways of nucleotides to various cellular functions.
BC434.CO3 Analyze and apply different techniques according to the sample and design the experiments in research projects.
BC434.CO4 Apply the analytical skills to research projects.

Bharatiya Vidya Bhavan

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Department of Biochemistry& Nutrition
(Academic year 2023-24)

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

COURSE NAME: QUANTITATIVE ANALYSIS AND BIOCHEMICAL TECHNIQUES

PAPER CODE: BC434P **PPW: 3**
YEAR/SEMESTER: II/IV **NO.OF CREDITS: 1**

COURSE OBJECTIVES:

COb1 To understand the different quantitative methods for amino acids and proteins.
COb2 To learn different biochemical techniques for the separation of biomolecules.

1. Estimation of amino acid by ninhydrin method.
2. Estimation of protein by Biuret method.
3. Estimation of protein by Lowry's method.
4. Separation of plant pigments from various leaf and vegetable sources by TLC.
5. Separation of amino acids by paper electrophoresis.
6. Separation of proteins by SDS-PAGE and staining by Coomassie blue.
7. Separation of amino acids by paper chromatography.
8. Determination of ion exchange capacity of a resin by titrimetry.
9. Gel filtration chromatography.
10. Data analysis and construction of line, pie and bar graphs.

REFERENCES:

1. Experimental Biochemistry-A student companion-Beedu Sashidhar Rao and Vijay Deshpande.
2. An Introduction to Practical Biochemistry-Plummer, D. T. Tata McGraw –Hill.
3. Introductory Practical Biochemistry (ed) Sawhney, S. K. Randhir Singh-Narosa Publications House.

COURSE OUTCOMES:

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

BC434P.CO1 Quantify amino acids and proteins in different samples.
BC434P.CO2 Apply the relevant biochemical technique to analyse the sample for research purpose.

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COURSE NAME: CLINICAL LABORATORY DIAGNOSTICS

PAPER CODE: SE434 **PPW: 2**
YEAR/SEMESTER: II/IV **NO.OF CREDITS: 2**

COURSE OBJECTIVE: To familiarize students with theory and practical aspects of various clinical laboratory diagnostic tests of blood and urine.

UNIT-WISE COURSE OBJECTIVES:

COb1 To explain about clinical laboratory automation, methods of specimen collection and preservation.
COb2 To explain about biochemical tests associated with various organ functions.

Unit I Clinical Biochemistry **15 hrs**

1. Organization of clinical laboratory. Introduction to instrumentation and automation in clinical biochemistry laboratories, safety regulations and first aid.
2. General comments on specimen collection, types of specimen for biochemical analysis.
3. Precision, accuracy, quality control, precautions and limitations of specimen collection.
4. Basic physiology of hepatic, renal and cardiovascular systems.
5. Biochemical symptoms associated with hepatic and renal diseases and their diagnostic biochemical profile.
6. Clinical significance of variations in blood glucose. Diabetes mellitus.
7. Composition and functions of lipoproteins. Clinical significance of elevated lipoproteins.
8. Liver function tests.
9. Renal function tests and urine analysis.
10. Involvement of enzymes in diagnosis of heart disease including aspartate transaminase, isoenzymes of creatine kinase and lactate dehydrogenase and troponin.

Unit II: Practicals **15 hrs**

1. Collection of blood and storage.
2. Separation and storage of serum.
3. Estimation of blood glucose by glucose oxidase-peroxidase method.
4. Estimation of serum Triglycerides.
5. Estimation of bilirubin (direct and indirect).

6. Use of urine strip / dipstick method for urine analysis.
7. Quantitative determination of serum creatinine.
8. Quantitative determination of serum urea.
9. Estimation of creatine kinase MB.
10. Estimation of SGOT.

References:

1. Medical Laboratory Technology - a Procedure Manual for Routine Diagnostic Tests Vol. I (2010), Mukherjee, K.L., Tata Mc Graw–Hill Publishing Company Limited (New Delhi). ISBN:9780070076594 / ISBN:9780070076631
2. Medical Laboratory Technology - a Procedure Manual for Routine Diagnostic Tests Vol. II (2010), Mukherjee, K.L., Tata Mc Graw – Hill Publishing Company Ltd. (New Delhi), ISBN: 9780070076648.
3. Medical Biochemistry (2005) 2nded., Baynes, J.W. and Dominiczak, M.H., Elsevier Mosby Ltd. (Philadelphia), ISBN:0-7234-3341-0.
4. Experimental Biochemistry: A Student Companion (2005) Rao, B.S. and Deshpande, V., IK International Pvt. Ltd. (New Delhi), ISBN:81-88237-41-8.
5. Textbook of Medical Laboratory Technology: Godkar P.B. and Godkar D.p.2ndEdition, Bhalani publishing House
6. Textbook of Medical Physiology: Guyton A.C. and Hall J.E., Saunders publications

COURSE OUTCOMES:

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

SE434.CO1 Apply the knowledge in collection and preservation of blood and urine samples in diagnostic labs.
SE434.CO2 Perform the diagnostic tests and analyze the results associated with various organ functions in health and disease.

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