

**Telangana State Council of Higher Education, Govt. of Telangana**  
**B.Sc., CBCS Common Core Syllabi for all Universities in Telangana (wef 2016-'17)**

**PROPOSED SCHEME FOR CHOICE BASED CREDIT SYSTEM IN**  
**B.Sc., BIOCHEMISTRY**

<b>FIRST YEAR – SEMESTER I</b>				
<b>Code</b>	<b>Course Title</b>	<b>Course Type</b>	<b>HPW</b>	<b>Credits</b>
BS 101	Environmental Studies	AECC 1	2	2
BS 102	English	CC-1A	5	5
BS 103	Second Language	CC-2A	5	5
BS 104	Chemistry of Biomolecules	DSC - 1A	4T+2P=6	4+1=5
BS 105	Optional II	DSC - 2A	4T+2P=6	4+1=5
BS 106	Optional III	DSC - 3A	4T+2P=6	4+1=5
	<b>TOTAL</b>			<b>27</b>
<b>SEMESTER II</b>				
BS 201	Gender Sensitization	AECC 2	2	2
BS 202	English	CC-1B	5	5
BS 203	Second Language	CC-2B	5	5
BS 204	Chemistry of Nucleic acids and Biochemical Techniques	DSC -1B	4T+2P=6	4+1=5
BS 205	Optional II	DSC -2B	4T+2P=6	4+1=5
BS 206	Optional III	DSC -3B	4T+2P=6	4+1=5
	<b>TOTAL</b>			<b>27</b>
<b>SECOND YEAR- SEMESTER III</b>				
BS 301	Computational Biochemistry	SEC -1	2	2
BS 302	English	CC-1C	5	5
BS 303	Second Language	CC-2C	5	5
BS 304	Bioenergetics, Biological oxidation and Enzymology	DSC- 1C	4T+2P=6	4+1=5
BS 305	Optional II	DSC- 2C	4T+2P=6	4+1=5
BS 306	Optional III	DSC- 3C	4T+2P=6	4+1=5
	<b>TOTAL</b>			<b>27</b>
<b>SEMESTER IV</b>				
BS 401	Medical Lab Technology	SEC – 2	2	2
BS 402	English	CC-1D	5	5
BS 403	Second Language	CC-2D	5	5
BS 404	Intermediary Metabolism	DSC- 1D	4T+2P=6	4+1=5
BS 405	Optional II	DSC- 2D	4T+2P=6	4+1=5
BS 406	Optional III	DSC- 3D	4T+2P=6	4+1=5
	<b>TOTAL</b>			<b>27</b>

<b>THIRD YEAR- SEMESTER V</b>				
BS 501	Applied Biochemistry	SEC-3	2	2
BS 502	Physiology and Biochemistry	GE-1	2	2
BS 503	Physiology and Clinical Biochemistry	DSC-1E	3T+2P=5	3+1=4
BS 504	Optional II	DSC-2E	3T+2P=5	3+1=4
BS 505	Optional III	DSC-3E	3T+2P=5	3+1=4
BS 506	A- Molecular Biology	DSE-1E	3T+2P=5	3+1=4
	B- Cell Biology and Genetics			
BS 507	Optional II A/B/C	DSE-2E	3T+2P=5	3+1=4
BS 508	Optional III A/B/C	DSE-3E	3T+2P=5	3+1=4
	<b>TOTAL</b>			<b>28</b>
<b>SEMESTER VI</b>				
BS 601	Mini Project (4 weeks)	SEC- 4	2	2
BS 602	Nutrition in health and disease	GE-2	2	2
BS 603	Nutrition and Immunology	DSC-1F	3T+2P=5	3+1=4
BS 604	Optional II	DSC-2F	3T+2P=5	3+1=4
BS 605	Optional III	DSC-3F	3T+2P=5	3+1=4
BS 606	A- Microbiology and r-DNA technology	DSE-1F	3T+2P=5	3+1=4
	B- Biotechnology			
BS 607	Optional II A/B/C	DSE-2F	3T+2P=5	3+1=4
BS 608	Optional III A/B/C	DSE-3F	3T+2P=5	3+1=4
	<b>TOTAL</b>			<b>28</b>
	<b>TOTAL CREDITS</b>			<b>164</b>

CC- Core Course

AECC- Ability Enhancement Compulsory Course

DSC- Discipline Specific Core

SEC- Skill Enhancement Course

DSE- Discipline Specific Elective

GE- Generic Elective

HPW – Hours per week

## SEC - 1

### Semester – III: Paper BS 301: COMPUTATIONAL BIOCHEMISTRY (2 Credits; 2 Hr/week)

#### Credit-I: Biochemical Data Analysis and Molecular Graphics

1. Computational Science and Applications of Computers in Biochemistry
2. Biochemical data analysis and Management (Spread sheets and Databases)
3. Internet resources and data retrieval
4. Visualization of Biomolecules by computer graphics
5. Drawing and display of structures.

#### Credit-II: Dynamics of Computational Biochemistry

1. Databases of Receptor-Biomolecule interactions
2. Study of Enzyme Kinetics
3. Metabolic databases
4. Gene identification, Protein sequence analysis
5. Principles of molecular modelling.

#### References:

1. An Introduction to Computational Biochemistry by C. Stan Tsai, A JOHN WILEY & SONS, INC., PUBLICATION
2. Computational Biochemistry and Biophysics by Oren M. Becker, Alexander D. MacKerell Jr., Benoit Roux, Masakatsu Watanabe. CRC Press, Taylor & Francis Group.

**DSC – 1C**  
**Semester – III: Paper-BS304 (Theory): BIOENERGETICS, BIOLOGICAL OXIDATIONS**  
**AND ENZYMOLOGY**  
**(4 Credits; 4 Hr/week)**

**Credit- I : Bioenergetics**

1. Energy transformations in the living system
2. Free energy, Enthalpy and Entropy concepts.
3. Exergonic and endergonic reactions.
4. High energy compounds.
5. Phosphate group transfer potential.
6. Substrate level phosphorylation.
7. Cytochromes-structure, types and their functions

**Credit – II: Biological Oxidations**

1. Biological oxidations: Definition, enzymes involved- oxidases, dehydrogenases and oxygenases.
2. Redox reactions. Redox couplers. Reduction potential ( $\varepsilon$ ,  $\varepsilon_0$ ,  $\varepsilon'_0$ ). Standard reduction potential ( $\varepsilon'_0$ ) of some biochemically important half reactions.
3. Ultrastructure of mitochondria, Electron transport chain and carriers involved.
4. Oxidative phosphorylation, theories of oxidative phosphorylation- Mitchell's chemiosmotic theory.  $F_0 F_1$ - ATPase, Inhibitors of respiratory chain and oxidative phosphorylation, uncouplers.
5. Formation of reactive oxygen species and their disposal through enzymatic reactions.
6. Ultrastructure of chloroplast
7. Cyclic and non-cyclic photophosphorylation.

**Credit- III : Introduction to Enzymology**

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

**Credit – IV: Enzyme Kinetics and Enzyme action**

1. Rate of a Reaction – Law of Mass action, Factors affecting the catalysis- substrate concentration, pH, temperature, Time, Enzyme concentration and Product concentration
2. Michaelis - Menten equation for single substrate reaction, significance of  $K_M$  and  $V_{max}$ .
3. Enzyme inhibition- irreversible and reversible, types of reversible inhibitions- competitive and non-competitive.
4. Outline of mechanism of enzyme action- acid-base catalysis, covalent catalysis, electrostatic catalysis, and metal ion catalysis.
5. Regulation of enzyme activity- allosterism and cooperativity, ATCase as an allosteric enzyme, covalent modulation- covalent phosphorylation of phosphorylase
6. Zymogen activation- activation of trypsinogen and chymotrypsinogen.
7. Isoenzymes (LDH) and Multienzyme complexes (PDH). Ribozyme.

## References:

1. Lehninger's Principles of Biochemistry – Nelson.D.L. and Cox.M.M., Freeman & Co.
2. Biochemistry – Berg.J.M., Tymoczko.J.L. and Stryer.L., Freeman & Co.
3. Biochemistry – Voet.D and Voet., J.G., John Wiley & Sons .
4. Textbook of Biochemistry – West.E.S.,Todd.W.R,Mason.H.S..and. Bruggen, J.T.V., Oxford & IBH Publishers.
5. Outlines of Biochemistry – Conn.E.E.,Stumpf.P.K., Bruening, G and Doi.R.H., John Wiley & Sons .
6. Harper's Illustrated Biochemistry – Murray, R.K., Granner.D.K. & Rodwell,V.W., McGraw-Hill
7. Biochemistry-Lippincott's Illustrated Reviews. Champe, P.C. and Harvey, R. A. Lippincott
8. Fundamentals of Biochemistry –Jain, J.L., Jain, S., Jain, N. S. Chand & Co.
9. Biochemistry – Satyanarayana. U and Chakrapani. U, Books & Allied Pvt. Ltd.
10. Fundamentals of Enzymology – Price.N.C.and Stevens.L., Oxford University Press.
11. Understanding Enzymes – Palmer.T., Ellis Harwood.
12. Enzymes – Biochemistry, Biotechnology, Clinical Chemistry – Palmer.T., Affiliated East-West Press

**DSC – 1C**  
**Semester – III: Paper-BS304 (Practicals): ENZYMOLOGY**  
**(1 Credits; 2 Hr/week)**

1. Assay of salivary  $\alpha$ -amylase
2. Assay of  $\beta$ -amylase from sweet potatoes
3. Assay of urease
4. Assay of catalase
5. Assay of phosphatase
6. Determination of optimum temperature and pH for amylase
7. Determination of optimum pH for phosphatase
8. Effect of Substrate concentration of amylase activity

**References**

1. Experimental Biochemistry-A student companion-Beedu Sashidhar Rao and VijayDeshpande.
2. Laboratory Manual in Biochemistry- Jayaraman, J. Wiley Eastern
3. Enzyme Assays- A practical Approach: Eisenthal, R and Dawson,M.I., IRL Press.
4. Biochemical Methods- Sadasivam,S and Manickyam,A. New Age International Publishers.

## SEC - 2

### Semester – IV: Paper BS 401: MEDICAL LAB TECHNOLOGY (2 Credits; 2 Hr/week)

#### Credit - I: Clinical Laboratory principles and Tests

1. Basic principles of Clinical Laboratory, Commonly used equipment and their maintenance, Preparation of reagents and Quality control
2. Phlebotomy - Collection, processing, preservation and transportation of various clinical samples
3. Physical and chemical examinations of urine, CSF, Semen,
4. Complete blood picture (CBP)
5. Tests for sickling, osmotic fragility, G6PD enzyme deficiency, Coomb's test, Identification of Blood parasites and Clinical Enzymology

#### Credit - II: Microbiology and Immunology

1. Histopathology and cytopathology (Preparation of common stains)
2. Microbiology – Basic principles of culture, isolation of bacteria from blood, CSF, tissue, sputum, throat swab, nasal, eye swabs, aural swab, vaginal swab, wound swab, rectal swab, urine, pleural fluid, ascetic fluid, AFB culture
3. Identification of Cocci, Corynebacteria, Diptheria, Mycobacteria, Gram negative bacilli and Gram positive bacilli
4. Techniques of RA factor, VDRL, Widal, Auto Antibodies, Hepatitis, HIV testing and EBV etc
5. Immuno-histochemical staining methods for auto-antibodies and tumour markers.

#### References:

1. Fischbach, 2005. Manual of lab and diagnostic tests, Lippincott Williams Wilkins, New York.
2. Gradwohls, 2000. Clinical laboratory methods and diagnosis. (ed) Ales C. Sonnenwirth and Leonard Jarret, M.D.B.I., New Delhi.
3. J Ochei and Kolhatkar, 2002. Medical laboratory science theory and practice, Tata McGraw-Hill, New Delhi.
4. Kanai L. Mukherjee, 2007, Medical laboratory technology Vol.1. Tata McGraw Hill

**DSC – 1 D**  
**Semester – IV: Paper-BS 404 (Theory): INTERMEDIARY METABOLISM**  
**(4 Credits; 4 Hr/week)**

**Credit-I : Amino acid Metabolism**

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

**Credit- II : Carbohydrate Metabolism**

1. Concept of anabolism and catabolism.
2. Glycolytic pathway, energy yield. Fate of pyruvate- formation of lactate and ethanol, Pasteur effect.
3. Citric acid cycle, regulation, energy yield, amphipathic role. Anaplerotic reactions.
4. Glycogenolysis and glycogenesis.
5. Pentose phosphate pathway.
6. Gluconeogenesis.
7. Photosynthesis- Light and Dark reactions, Calvin cycle and C<sub>4</sub> Pathway, CAM Pathway

**Credit – III: Lipid Metabolism**

1. Catabolism of fatty acids ( $\beta$ - oxidation) with even and odd number of carbon atoms
2. Ketogenesis
3. *de novo* synthesis of fatty acids
4. Elongation of fatty acids in mitochondria and microsomes
5. Biosynthesis and degradation of triacylglycerol
6. Biosynthesis of lecithin.
7. Biosynthesis of cholesterol.

**Credit – IV : Nucleic acid Metabolism**

1. Biosynthesis of purine and pyrimidine nucleotides, *de novo* and salvage pathways.
2. Regulation of purine and pyrimidine nucleotides
3. Catabolism of purines and pyrimidines.
4. Biosynthesis of deoxyribonucleotides- ribonucleotide reductase and thymidylate synthase and their significance.
5. Disorders of nucleotide metabolism- Gout, Lesch- Nyhan syndrome.
6. Biosynthesis of heme
7. Degradation of heme

## References

1. Lehninger's Principles of Biochemistry – Nelson.D.L. and Cox.M.M., Freeman & Co.
2. Biochemistry – Berg.J.M., Tymoczko.J.L. and Stryer.L., Freeman & Co.
3. Biochemistry – Voet.D and Voet., J.G., John Wiley & Sons .
4. Textbook of Biochemistry – West.E.S.,Todd.W.R,Mason.H.S..and. Bruggen, J.T.V., Oxford & IBH Publishers.
5. Principles of Biochemistry: General Aspects-Smith, E. L., Hill, R.L. Lehman, I. R. Lefkowitz, R.J. Handler, P., and White, A. McGraw-Hill
6. Outlines of Biochemistry – Conn.E.E.,Stumpf.P.K., Bruening, G and Doi.R.H., John Wiley & Sons .
7. Harper's Illustrated Biochemistry – Murray, R.K., Granner.D.K. & Rodwell,V.W., McGraw-Hill
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8. Fundamentals of Biochemistry –Jain, J.L., Jain, S., Jain, N. S. Chand & Co.
9. Biochemistry – Satyanarayana. U and Chakrapani. U, Books & Allied Pvt. Ltd.
10. Biochemistry – Rama Rao. A and Ratna Kumari. D, Kalyani Publishers.
11. Biochemistry- The Molecular Basis of Life – McKee. T and McKee, J. R, McGraw-Hill.

**DSC – 1 D**  
**Paper-BS404 (Practicals): BIOCHEMICAL PREPARATIONS AND SEPARATIONS**  
**(1 Credits; 2 Hr/week)**

1. Absorption maxima of colored substances- *p*-Nitrophenol, Methyl orange and  $\text{KMnO}_4$ .
2. Absorption spectra of Amino acid – Tyrosine; protein-BSA, nucleic acids- Calf thymus DNA.
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. Separation of Plant pigments by TLC

**References**

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