

**Telangana State Council of Higher Education, Govt .of Telangana  
BSc CBCS Common Core Syllabi for All Universities in Telangana  
Pattern for each Optional in BSc Biotechnology Course**

<b>Year</b>	<b>Semester</b>	<b>Course Type</b>	<b>Credits-Theory</b>	<b>Teaching Hours per week-Theory</b>	<b>Credits-Practicals</b>	<b>Lab hours per week-Practical</b>	<b>Dept workload per week per section</b>
<b>FIRST YEAR</b>	<b>ONE</b>	BS106: Cell Biology and Genetics	4	4	1	2	6
	<b>TWO</b>	BS206 : Nucleic acids and Bioinformatics	4	4	1	2	6
<b>SECOND YEAR</b>	<b>THREE</b>	BS306: Biochemistry and Biostatistics	4	4	1	2	6
	<b>FOUR</b>	BS406: Microbiology and Immunology	4	4	1	2	6
<b>THIRD YEAR</b>	<b>FIVE</b>	BS505: Molecular Biology and r-DNA technology	3	3	1	2	5
		BS508 A- Elective: Plant Biotechnology	3	3	1	2	10(A+B)
		BS508 B- Elective: Medical Biotechnology BS502 GE1: Food Technology	2	2	-	-	2
	<b>SIX</b>	BS605: Microbial Technology	3	3	1	2	5
		BS608 A-Elective: Animal Biotechnology BS608 B-Elective: Environmental Biotechnology and Biodiversity	3	3	1	2	10(A+B)
		BS602 GE2: Biotechnology Perspectives	2	2	-	-	2

**\*OPTIONAL III-BIOTECHNOLOGY; GE: Generic Elective**

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**PROPOSED SCHEME FOR CHOICE BASED CREDIT SYSTEM IN BSc BIOTECHNOLOGY COURSE**

<b>FIRST YEAR: SEMESTER-I</b>				
<i>Code</i>	<i>Course title</i>	<i>Course type</i>	<i>HPW</i>	<i>Credits</i>
BS101	Communication	AECC-1	2	2
BS102	English	CC-1A	5	5
BS103	Second language	CC-2A	5	5
BS104	OPTIONAL-I	DSC-1A	4T+2P=6	4+1=5
BS105	OPTIONAL-II	DSC-2A	4T+2P=6	4+1=5
<b>BS106</b>	<b>Optional-III: Cell biology and Genetics</b>	<b>DSC-3A</b>	4T+2P=6	4+1=5
			<b>30</b>	<b>27</b>
<b>FIRST YEAR: SEMESTER-II</b>				
BS201	Environmental Studies	AECC-2	2	2
BS202	English	CC-1B	5	5
BS203	Second language	CC-2B	5	5
BS204	OPTIONAL-I	DSC-1B	4T+2P=6	4+1=5
BS205	OPTIONAL-II	DSC-2B	4T+2P=6	4+1=5
<b>BS206</b>	<b>Optional-III: Nucleic Acids and Bioinformatics</b>	<b>DSC-3B</b>	4T+2P=6	4+1=5
			<b>30</b>	<b>27</b>
<b>SECOND YEAR: SEMESTER-III</b>				
<b>BS301</b>	<b>Enzyme Technology</b>	<b>SEC-1</b>	2	2
BS302	English	CC-1C	5	5
BS303	Second language	CC-2C	5	5
BS304	OPTIONAL-I	DSC-1C	4T+2P=6	4+1=5
BS305	OPTIONAL-II	DSC-2C	4T+2P=6	4+1=5
<b>BS306</b>	<b>Optional-III: Biochemistry and Biostatistics</b>	<b>DSC-3C</b>	4T+2P=6	4+1=5
			<b>30</b>	<b>27</b>

<b>SECOND YEAR: SEMESTER-IV</b>				
<b>BS401</b>	<b>Immunotechnology</b>	<b>SEC-2</b>	2	2
BS402	English	CC-1D	5	5
BS403	Second language	CC-2D	5	5
BS404	OPTIONAL-I	DSC-1D	4T+2P=6	4+1=5
BS405	OPTIONAL-II	DSC-2D	4T+2P=6	4+1=5
<b>BS406</b>	<b>Optional-III: Microbiology and Immunology</b>	<b>DSC-3D</b>	4T+2P=6	4+1=5
			<b>30</b>	<b>27</b>
<b>THIRD YEAR: SEMESTER-V</b>				
BS501	E/F	SEC-3	2	2
<b>BS502</b>	<b>Food Technology</b>	<b>GE-1</b>	<b>2T</b>	<b>2</b>
BS503	OPTIONAL-I	DSC-1E	3T+2P=5	3+1=4
BS504	OPTIONAL-II	DSC-2E	3T+2P=5	3+1=4
<b>BS505</b>	<b>Molecular Biology and r-DNA Technology</b>	<b>DSC-3E</b>	3T+2P=5	3+1=4
BS506	OPTIONAL-I A/B/C	DSE-1E	3T+2P=5	3+1=4
BS507	OPTIONAL-II A/B/C	DSE-2E	3T+2P=5	3+1=4
<b>BS508A</b>	<b>Plant Biotechnology</b>	<b>DSE-3E</b>	3T+2P=5	3+1=4
<b>BS508B</b>	<b>Medical Biotechnology</b>			
			<b>34</b>	<b>28</b>
<b>THIRD YEAR: SEMESTER -VI</b>				
BS601	G/H	SEC-4	2	2
<b>BS602</b>	<b>Biotechnology Perspectives</b>	<b>GE-2</b>	<b>2T</b>	<b>2</b>
BS603	OPTIONAL-I	DSC-1F	3T+2P=5	3+1=4
BS604	OPTIONAL-II	DSC-2F	3T+2P=5	3+1=4
<b>BS605</b>	<b>Microbial Technology</b>	<b>DSC-3F</b>	<b>3T+2P=5</b>	<b>3+1=4</b>
BS606	OPTIONAL-I A/B/C	DSE-1F	3T+2P=5	3+1=4
BS607	OPTIONAL-II A/B/C	DSE-2F	3T+2P=5	3+1=4
<b>BS608A</b>	<b>Animal Biotechnology</b>	<b>DSE-3F</b>	<b>3T+2P=5</b>	<b>3+1=4</b>
<b>BS608B</b>	<b>Environmental Biotechnology and Biodiversity</b>			
			34	28
	<b>TOTAL CREDITS</b>			<b>164</b>

**\*Optional III BIOTECHNOLOGY**

AECC: Ability Enhancement Compulsory Course; SEC: Skill Enhancement Course; DSC: Discipline Specific Course; DSE: Discipline Specific Elective; GE: Generic Elective

**BSc BIOTECHNOLOGY II YEAR  
SEMESTER III  
SKILL ENHANCEMENT COURSE -1 (SEC- 1)  
BS301: ENZYME TECHNOLOGY**

**Unit 1: Enzymes for Industrial use**

- 1.1.Sources of production, isolation and purification of enzymes for industrial use
- 1.2.Applications of isolated enzymes in food and beverage industry
- 1.3.Applications of isolated enzymes in detergents and leather industry
- 1.4.Applications of isolated enzymes in production of organic chemicals
- 1.5.Immobilization of Enzymes- Methods of Enzyme immobilization and advantages
- 1.6.Applications of immobilized enzymes

**Unit 2: Enzymes for Clinical diagnosis**

- 2.1.Determination of enzyme activity for clinical diagnosis of Liver disease
- 2.2.Determination of enzyme activity for clinical diagnosis of Heart disease
- 2.3.Determination of enzyme activity for clinical diagnosis of other diseases (Pancreatitis and skeletal muscle disorder)
- 2.4.Detection and significance of enzyme deficiencies (Phenylketonuria & Galactosaemia)
- 2.5.Enzymes in determination of metabolites of clinical importance (Blood glucose, Uric acid & Cholesterol)
- 2.6.Therapeutic use of enzymes- Treatment of Genetic deficiency diseases, Cancer

**REFERNCE BOOKS**

1. Biochemistry, Lubert Stryer, 6th Edition, WH Freeman, 2006.
2. Harper's illustrated Biochemistry by Robert K. Murray, David A Bender, KathleenM.Botham, Peter J. Kennelly, Victor W. Rodwell, P. Anthony Weil. 28th Edition, McGrawHill, 2009.
3. Biochemistry, Donald Voet and Judith Voet, 2nd Edition, Publisher: John Wiley and Sons, 1995.
4. Biochemistry by Mary K.Campbell & Shawn O.Farrell, 5th Edition, Cenage Learning, 2005.
5. Fundamentals of Enzymology Nicholas Price and Lewis Stevens Oxford University Press, 1999
6. Fundamentals of Enzyme Kinetics Athel Cornish-Bowden Portland Press 2004
7. Practical Enzymology Hans Bisswanger Wiley-VCH 2004
8. The Organic Chemistry of Enzyme-catalyzed Reactions Richard B. Silverman Academic Press, 2002

**BSc BIOTECHNOLOGY II YEAR  
SEMESTER III (DSC-3C)  
BS306- BIOCHEMISTRY AND BIOSTATISTICS**

**Unit 1: Biomolecules**

- 1.1 Carbohydrates- importance, classification; structure and functions of monosaccharides (glucose & fructose), disaccharides (sucrose, lactose & maltose) and polysaccharides (starch, glycogen & inulin)
- 1.2 Amino acids- importance, classification, structure, physical and chemical properties of amino acids; peptide bond formation
- 1.3 Proteins- importance, structure of proteins- primary, secondary, tertiary and quaternary
- 1.4 Lipids- importance, classification- simple lipids (triacylglycerides & waxes), complex lipids (phospholipids & glycolipids), derived lipids (steroids, terpenes & carotenoids)
- 1.5 Fatty acids- importance, classification- saturated (palmitic acid, arachidic acid) and unsaturated fatty acids (oleic acid & linoleic acid)
- 1.6 Enzymes- importance, classification and nomenclature; Michaelis-Menton Equation, factors influencing the enzyme reactions; enzyme inhibition (competitive, uncompetitive & mixed), co-enzymes

**Unit 2: Bioenergetics and Bioanalytical techniques**

- 2.1 Glycolysis, tricarboxylic acid (TCA) cycle, electron transport, oxidative phosphorylation
- 2.2 Gluconeogenesis and its significance
- 2.3 Transamination and oxidative deamination reactions of amino acids and  $\beta$ -oxidation of fatty acids
- 2.4 Colorimetry: Beer and Lambert's laws and UV- vis spectrophotometry
- 2.5 Principle and applications of chromatography (paper, thin layer & HPLC), Electrophoresis (Agarose & SDS-PAGE)
- 2.6 Principle and applications of centrifugation (preparative & analytical)

**Unit 3: Biostatistics-Basic concepts**

- 3.1 Introduction to Biostatistics; methods of sampling-random & non-random
- 3.2 Diagrammatic (line diagram, bar diagram & pie diagram) and graphic representation of data (histogram, frequency polygon & frequency curve)
- 3.3 Measures of central tendency- arithmetic mean (individual, discrete & continuous) merits and demerits
- 3.4 Measures of central tendency- median (individual, discrete & continuous); merits and demerits
- 3.5 Measures of central tendency- mode (individual, discrete & continuous); merits and demerits
- 3.6 Measures of dispersion- range, mean deviation, variance and standard deviation

**Unit 4: Biostatistics-Applications**

- 4.1 Probability, probability distribution-Binomial, Poisson and Normal distributions
- 4.2 Test of significance- Null hypothesis and Alternate hypothesis
- 4.3 Comparisons of means of two samples by t-test (paired & un-paired)
- 4.4 Chi-square test- degrees of freedom and their applications to biology (goodness of fit)
- 4.5 Correlation and regression analysis and their applications to biology
- 4.6 Analysis of variance (One-way ANOVA) and their applications to biology

**PRACTICALS**

**CORE- III:**

**BS306: BIOCHEMISTRY AND BIostatISTICS**

1. Qualitative tests of sugars, amino acids and lipids
2. Estimation of total sugars by anthrone method
3. Reducing sugars by DNS method
4. Separation of amino acids by paper chromatography
5. Estimation of proteins by biuret method
6. Amylase activity assay
7. Graphical representation of data (histogram, frequency polygon & pie-diagram)
8. Measures of central tendency- mean, median & mode
9. Measures of dispersion- mean deviation & standard deviation
10. Chi-square test for goodness of fit
11. Correlation and regression analysis
12. One-way ANOVA analysis

**REFERENCE BOOKS**

1. Lehninger Principles of Biochemistry By: David L. Nelson and Cox
2. Biochemistry By: Rex Montgomery
3. Harper's Biochemistry By: Robert K. Murray
4. Enzymes By: Trevor Palmer
5. Enzyme structure and mechanism By: AlanFersht
6. Principles of Biochemistry By: Donald J. Voet, Judith G.Voet, Charlotte W.Pratt
7. Analytical Biochemistry By: Cooper
8. Principles and techniques of Biochemistry and Molecular Biology Edited By: Keith Wilson and John Walker
9. Experimental Biochemistry: A Student Companion by: Sashidhar Beedu et al.
10. Practical Biochemistry By: Plummer
11. Fundamentals of Biostatistics: Khan and Khanum. Ukaaz publications, India
12. Biometry by: Sokal and Rohlf W.H. Freeman
13. Biostatistics by: N.T.J. Bailey
14. Biostatistics; Jayasree publishers by: Vishweswara Rao K
15. Biostatistics; Himalaya publishing house by: Arora, P.N & Mashan P.K.
16. Biostatistics by: S. Prasad

**BSc BIOTECHNOLOGY II YEAR  
SEMESTER III  
SKILL ENHANCEMENT COURSE -2 (SEC- 2)  
BS401: IMMUNOTECHNOLOGY**

**Unit 1: Antibody assays- Principle, Methodology & Applications**

- 1.1 Precipitation & Agglutination reactions
- 1.2 Immuno diffusion & Radial diffusion
- 1.3 Immunoelectrophoresis
- 1.4 Western blotting & ELISA
- 1.5 RIA & Immunofluorescent assay
- 1.6 Immunohistochemistry

**Unit 2: Cellular Assays- Principle, Methodology & Applications**

- 2.1 Total and differential count in human peripheral blood
- 2.2 Separation of mononuclear cells from human peripheral blood
- 2.3 Lymphocyte transformation assay
- 2.4 Micro cytotoxicity assay for HLA typing
- 2.5 Enumeration of T & B-cells from human peripheral blood
- 2.6 Cell mediated cytotoxicity

**REFERENCE BOOKS**

1. Essential Immunology - By I. Roitt, Publ: Blackwell
2. Immunology - By G. Reeve & I. Todd, Publ: Blackwell
3. Abbas AK, Lichtman AH, Pillai S. Cellular and Molecular Immunology. Saunders Publication, Philadelphia
4. Golds by RA, Kindt TJ, Osborne BA. Kuby's Immunology. W.H. Freeman and Company, New York

**BSc BIOTECHNOLOGY II YEAR  
SEMESTER IV (DSC-3D)  
BS406- MICROBIOLOGY AND IMMUNOLOGY**

**Unit 1: Fundamentals of Microbiology**

- 1.1 Historical development of microbiology and contributors of microbiology
- 1.2 Microscopy: Bright field microscopy, Dark field microscopy, Phase contrast microscopy, Fluorescent microscopy, Scanning and Transmission electron microscopy
- 1.3 Outlines of classification of microorganisms
- 1.4 Structure and general characteristics of bacteria and virus
- 1.5 Disease causing pathogens and symptoms (Eg: *Mycobacterium*, *Hepatitis*)
- 1.6 Structure and general characteristics of micro-algae and fungi

**Unit 2: Culture and identification of microorganisms**

- 2.1 Methods of sterilization- physical and chemical methods
- 2.2 Bacteriological media: LB media, EMB agar; Identification of bacteria by staining methods
- 2.3 Bacterial growth curve and factors affecting bacterial growth
- 2.4 Identification of viruses by plaque assay method
- 2.5 Algal media: Bristols media, Pringsteins media; Identification of algae by Benecks broth
- 2.6 Fungal media- PDA, Czapek-dox agar, Sabourauds agar; Identification of fungi by lactophenol test

**Unit 3: Basics of immunology**

- 3.1 Types of immunity- innate and adaptive immunity
- 3.2 Cells of the immune system: T-cells (helper and cytotoxic cells), B-cells, Natural killer cells, Macrophages, Basophils and Dendritic cells
- 3.3 Primary organs of immune system- Thymus and Bone marrow
- 3.4 Secondary organs of immune system- Spleen and Lymph nodes
- 3.5 Antigens-immunogenicity vs antigenicity, factors affecting antigenicity, epitopes,
- 3.6 Haptens & types of adjuvants

**Unit 4: Humoral and Cell mediated immunity**

- 4.1 Structure of immunoglobulin; types and functions of immunoglobulins (IgG, IgA, IgM, IgE & IgD)
- 4.2 Monoclonal antibody (MAbs) production and its applications
- 4.3 Major Histocompatibility Complex (MHC) & Human Leukocyte Antigen (HLA)- role in organ transplantation
- 4.4 Cell mediated immunity- T-cell receptor (TCR), Antigen Presenting Cells (APCs), ternary complex (TCR, peptide & MHC); cytokines
- 4.5 Hypersensitivity- types (I, II, III & IV)
- 4.6 Autoimmunity- Mechanisms of autoimmunity; Autoimmune diseases- Systemic lupus erythematosus, Rheumatoid arthritis

**PRACTICALS**

**CORE- IV**

**BS406: MICROBIOLOGY AND IMMUNOLOGY**

1. Sterilization methods
2. Preparation of microbiological media (bacterial, algal & fungal)
3. Isolation of bacteria by streak, spread and pour plate methods
4. Isolation of bacteria from soil
5. Simple staining and differential staining (gram's staining)
6. Bacterial growth curve
7. Microhaemagglutination (eg. ABO & Rh blood grouping)
8. Viability tests of cells (trypan blue test)
9. Differential leukocyte count
10. Single radial immunodiffusion
11. ELISA

**REFERENCE BOOKS**

5. Biology of Microorganisms by: Brock, T.D. and Madigan, M.T.
6. Microbiology by: Prescott, L.M., Harley, J.P. Klein, D.A.
7. Microbiology by: Pelczar, M.J, Chan, E.C.S., Ereig, N.R.
8. Microbiological applications by: Benson
9. Essential Immunology. Publ: Blackwell by: Roitt I.
10. Immunology. Publ: Blackwell by: Reeve G. & Todd I.
11. Cellular and Molecular Immunology. Saunders Publication, Philadelphia by: Abbas A.K., Lichtman A.H., Pillai S.
12. Kuby's Immunology. W.H. Freeman and Company by: Golds R.A., Kindt T.J., Osborne B.A.