

# Biotechnology

**B.Sc. I Year ( I - IV Semesters ) Syllabus (CBCS)**  
( w.e.f. 2016 - 2017 )



Faculty of Science

**PALAMURU UNIVERSITY**

Mahabubnagar - 509 001, Telangana

2016

**Telangana State Council of Higher Education, Govt of Telangana**  
**BSc CBCS Common Core Syllabi for All Universities in Telangana**

**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

**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**

Year	Semester	Course Type	Credits-Theory	Teaching Hours per week-Theory	Credits-Practicals	Lab hours per week-Practical	Dept workload per week per section
<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**

**SEMESTER-I**  
**CORE THEORY-I**  
**CELL BIOLOGY AND GENETICS**

**Unit 1: Cell structure and Functions**

- 1.1. Cell as basic unit of living organisms-bacterial, fungal, plant and animal cells
- 1.2. Ultrastructure of prokaryotic cell (cell membrane and plasmids, Nucleoid)
- 1.3. Ultrastructure of eukaryotic cell (cell wall, cell membrane, nucleus, mitochondria, chloroplast, endoplasmic reticulum, Golgi apparatus, vacuoles)
- 1.4. Fluid mosaic model, Sandwich model, Cell membrane permeability
- 1.5. Structure of chromosome-morphology, components of chromosomes (histones and non-histones), specialized chromosomes (Polytene, Lampbrush)
- 1.6. Chromosomal aberrations- structural and numerical

**Unit 2: Cell cycle**

- 2.1 Bacterial cell division
- 2.2 Eukaryotic cell cycle –phases
- 2.3 Mitosis - Stages (spindle assembly)-significance
- 2.4 Meiosis- Stages (synaptonemal complex)-significance
- 2.5 Senescence and necrosis
- 2.6 Apoptosis

**Unit 3: Principles and mechanism of inheritance**

- 3.1 Mendel's experiments- factors contributing to success of Mendel's experiments
- 3.2 Law of segregation- Monohybrid Ratio; Law of independent assortment- Dihybrid Ratio, Trihybrid Ratio
- 3.3 Deviation from Mendel's laws- partial or incomplete dominance (eg: Flower Color in *Mirabilis jalapa*), Co-dominance (eg: MN Blood groups), Non allelic interactions-types of epistasis, modification of dihybrid ratios
- 3.4 Penetrance and Expressivity (eg: Polydactyly, Waardenburg syndrome), pleiotropism, phenocopy- microcephaly, cleft lip
- 3.5 Multiple allelism (eg: Coat color in Rabbits, eye color in *Drosophila* and ABO Blood groups)
- 3.6 X-Y chromosomes - Sex determination in *Drosophila*, Birds, Man, *Bonellia*; X-linked inheritance– Hemophilia and Color blindness; X-inactivation; Y-linked inheritance- Holandric genes

**Unit 4: Linkage, Recombination and Extension to Mendel's Laws**

- 4.1 Linkage and recombination- Cytological proof of crossing over, phases of linkage, recombination frequency, gene mapping and map distance
- 4.2 Non-Mendelian Inheritance – Maternal effect (Shell coiling in snail), variegation in leaves of *Mirabilis jalapa*
- 4.3 Cytoplasmic male sterility in Maize and *Paramecium*,
- 4.4 Mitochondrial inheritance in human and poky in *Neurospora crassa*
- 4.5 Chloroplast inheritance in *Chlamydomonas*
- 4.6 Hardy-Weinberg Equilibrium, allelic and genotypic distribution

**CORE-I: PRACTICALS**

1. Microscopic observation of cells: bacteria, fungi, plant and animal
2. Preparation of different stages of Mitosis (onion root tips)
3. Preparation of different stages of Meiosis (grasshopper testis)
4. Preparation of Polytene chromosome from *Drosophila* salivary gland
5. Identification, maintenance and culturing of *Drosophila* stock
6. Monohybrid and dihybrid ratio in *Drosophila*
7. Monohybrid and dihybrid ratio in Maize
8. Problems on co-dominance, epistasis, two point and three point test cross, gene mapping, Tetrads analysis
9. Statistical applications of t-test
10. Statistical applications chi square test
11. Statistical applications of Hardy-Weinberg Equilibrium

**REFERENCE BOOKS**

1. Cell & Molecular Biology. E.D.D De Robertis & E.M.F De Robertis, Waverly publication
2. An introduction to Genetic Analysis by Anthony, J.F. J.A. Miller, D.T. Suzuki, R.C. Richard Lewontin, W.M-Gilbert, W.H. Freeman publication
3. Principles of Genetics by E.J.Gardner and D.P. Snusted. John Wiley & Sons, New York
4. The science of Genetics, by A.G. Atherly J.R. Girton, J.F. Mcdonald, Saundern College publication
5. Principles of Genetics by R.H. Tamarin McGrawhill
6. Theory & problems in Genetics by Stansfield, Schaum out line series McGrawhill
7. Molecular Cell Biology Lodish, H., Baltimore, D; fesk, A., Zipursky S.L., Matsudaride, P. and Darnel. American Scientific Books. W.H. Freeman, New York
8. The cell: A molecular approach. Geoffrey M Cooper, Robert E Hausman, ASM press
9. Cell and Molecular Biology, Concepts and Experiments – Gerald Karp, John Wiley & Sons, Inc

**SEMESTER II  
CORE THEORY II  
NUCLEIC ACIDS & BIOINFORMATICS**

**Unit 1: Nucleic Acids and Genome organization**

- 1.1 DNA as the genetic material- Griffith's experiments on transformation in *Streptococcus pneumoniae*, Hershey-Chase experiments with radio labeled T2 bacteriophage, Avery, MacLeod and McCarty's experiments
- 1.2 RNA as genetic material- Tobacco Mosaic Virus
- 1.3 Structure and forms of DNA (A, B and Z)
- 1.4 Genome organization in prokaryotes
- 1.5 Genome organization in eukaryotes, C-value and C-value paradox, Reassociation kinetics-cot curve, Denaturation, Renaturation, T<sub>m</sub> curve
- 1.6 Kinetic classes of DNA- unique sequences, moderately repeated and highly repeated sequences; tandem repeats (satellite, minisatellite and micro satellites), interspersed repeats (SINES-eg: Alu repeats, LINES); palindromic sequences and transposable genetic elements

**Unit 2: DNA Replication, Recombination and Repair**

- 2.1 DNA replication- enzymes; semi conservative DNA replication-Messelson and Stahl experiment; Linear, Circular, Rolling circle, Theta, D loop models
- 2.2 Mutation- spontaneous, induced (frame shift, transition, transversion)
- 2.3 Physical and chemical mutagens
- 2.4 DNA damage- intrinsic and extrinsic factors
- 2.5 DNA repair-Direct, Excision and methyl mediated mismatch, recombinational and SOS repair
- 2.6 DNA recombination-homologous, site specific recombination and NHEJ (Non-Homologous End Joining)

**Unit 3: Concepts of Bioinformatics**

- 3.1 Bioinformatics – a historical perspective
- 3.2 Internet and its role in bioinformatics
- 3.3 Bioinformatics Data: Genomes, nucleic acids, proteins, protein structures
- 3.4 Storage of databases in DNA (GenBank, EMBL, DDBJ)
- 3.5 Protein data banks (PDB, SWISS-PROT, UNIPROT, PIR) and their utilization
- 3.6 Data retrieval tools-BLAST, ENTREZ

**Unit 4: Applications of Bioinformatics**

- 4.1 Genome annotation: Gene identification tools
- 4.2 Basics of sequence alignment, Pairwise alignment (global and local)
- 4.3 Multiple sequence alignment and phylogenetic analysis
- 4.4 Structural classification of proteins and homology model building
- 4.5 Applications of Bioinformatics- drug targets, overview of drug designing
- 4.6 Concepts of Pharmacogenomics

**CORE-II: PRACTICALS**

1. Isolation of DNA from Plant cells
2. Isolation of DNA from Animal cells
3. Estimation of DNA by Diphenylamine method
4. Estimation of RNA by Orcinol method
5. Exploring data bases: Genbank and Uniprot
6. Exploring the structural data bases: PDB, MMDB
7. Visualization of Protein structures-RASMOL
8. Database searching and downloading bioinformatics data- DNA (Gen bank, DDBJ, ENA) Protein (Uniprot)
9. Pairwise sequence alignment (global and local) of DNA and proteins
10. Multiple sequence alignment of DNA & protein sequences using ClustalW
11. Database searching with heuristic algorithms: BLAST

**REFERENCE BOOKS**

1. Genes VII. Benjamin Lewin, Oxford Univ. Press, Oxford
2. Molecular Biology by D, Freifelder Narosa Publishing house New York, Delhi
3. Molecular Cell Biology Lodish, H., Baltimore, D; fesk, A., Zipursky S.L., Matsudaride, P. and Darnel. American Scientific Books. W.H. Freeman, NewYork
4. Molecular Biology by Brown
5. Essentials of Molecular Biology. D. Freifelder, Panima Publishing Corporation.
6. Bioinformatics: Sequence and Genome Analysis by David W. Mount, Cold Spring Harbor Laboratory Press
7. Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids by Richard Durbin, Sean R. Eddy, Anders Krogh, Graeme Mitchison, Cambridge University Press
8. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Andreas D. Baxevanis, B. F. Francis Ouellette, Wiley-Interscience
9. Bioinformatics tools and Resources – free online tools, downloadable free tools, software packages, internet, Bioinformatics books and Journals, Bioinformatics web-portals



**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, Kathleen M. 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, Cengage 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. Goldsby 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.