

**Shiksha Mandal's**  
**Bajaj College of Science, Wardha**  
**(Autonomous)**  
**B. Sc. Semester Pattern Syllabus**  
**B. Sc. Part I**  
**BIOTECHNOLOGY**  
**(With effect from academic session 2023-24)**  
**MINOR**

**B.Sc. Part I- Semester I**

<b>Sr. No.</b>	<b>Units</b>	<b>Total Theories Required</b>
1	Unit I	8
2	Unit II	12
3	Unit III	10
4	Unit IV	12
5	Unit V	12
6	Unit VI	12

**BIOTECHNOLOGY**  
**B. Sc. Semester Pattern Syllabus**  
**(With effect from academic session 2023-24)**  
**B. Sc. Part I – Semester I**  
**MINOR I**

**B. Sc. Part I – Semester I**

**FUNDAMENTALS OF BIOTECHNOLOGY AND BIOMOLECULES**

**Course Objectives:**

1. Students gain comprehensive knowledge about Application of Biotechnology in various field.
2. Students gain basic idea of viruses and their life cycles, prokaryotic cell, microbial nutrition, microscopy and staining techniques.
3. Student gets comprehensive knowledge regarding nucleic acid, proteins, amino acid, genes and chromosomes.
4. Students will be aware about the microbes present in the environment and their impact on environment. Course will provide practical knowledge about different types of bacterial staining, morphological characteristics of microorganism and colorimetric estimation of DNA, RNA and Protein.

**Course Outcomes**

1. Students will be able to understand application of Biotechnology, Genetic Engineering and Nano-technology in various important allied fields.
2. Student will be able to understand nutritional requirement, isolation and cultivation of microorganisms and staining and microscopy.
3. Students will be able to understand classification, characteristics of viruses, and life cycles of viruses.
4. Students will be able to know about classification and structures of biomolecules.

B.Sc. I (Semester I)	FUNDAMENTALS OF BIOTECHNOLOGY AND BIOMOLECULES (Minor-I)	UBT111T
Unit Number	Topic	Total Theories Required
I	<p><b>Introduction to Biotechnology</b></p> <p>A) Definition, National and International historical overview of Biotechnology.</p> <p>B) Scope of Biotechnology :</p> <ul style="list-style-type: none"> <li>• Biotechnology in Agriculture,</li> <li>• Biotechnology in Health &amp; Biopharmaceuticals</li> <li>• Biotechnology in Industry</li> <li>• Biotechnology in Environment &amp; Biodiversity</li> <li>• General outline of Genetic Engineering, Bioinformatics and Nano-Biotechnology</li> </ul>	8
II	<p><b>Microorganism and Microbial Nutrition</b></p> <p>A) Prokaryotes: Bacterial morphology and sub-cellular structure of typical bacterial cell. Structural details of Cell Wall of Gram Positive and Negative Bacteria</p> <p>B) Nutrition: Basic nutritional requirements: Basic idea of such nutrients as water, carbon, nitrogen, sulfur and vitamins etc., natural and synthetic media, nutritional classification of bacteria. Selective and Differential media, Enrichment media.</p> <p>C) Viruses: General characteristics of viruses, structure, different shapes and symmetries with one example of each type, classification of viruses LHT system, cultivation of viruses, Brief idea of lytic cycle and lysogenic cycle.</p>	12
III	<p><b>Microscopy and Staining Technique</b></p> <p>A) Definition: Magnification, Resolution, Numerical aperture, chromatic aberration,</p> <p>B) Principle, construction, working and applications of compound microscope, SEM and TEM</p> <p>C) Stains: Concept, aims of staining, smear preparation, principle and procedure of staining for :-</p> <ul style="list-style-type: none"> <li>• Bacteria ; Simple (monochrome &amp; negative staining);</li> <li>• Differential (Gram staining); Bacterial motility by hanging drop preparation method</li> <li>• Fungal staining by lactophenol cotton blue method</li> </ul>	10
IV	<p><b>Nucleic Acids</b></p> <p>A) Chemical structure and base composition of nucleic acids, Chargaff's rules, Watson Crick Model (B-DNA), deviations from Watson-Crick model, other forms of DNA (A- and Z-DNA), forces stabilizing nucleic acid structures, (hydrogen bonds and hydrophobic associations, base stacking).</p> <p>B) Structure of RNA( mRNA , tRNA, rRNA)</p>	12
V	<p><b>Chromosomes, Concept of Genes and Nucleosomes</b></p> <p>A) Concept of prokaryotic genes and eukaryotic genes: Definition of a gene, concept of split genes, introns, exons, spacers, C-value and C-value paradox, basic idea of Cot curves.</p> <p>B) Chromatin structure: Nucleosome structure (10 nm fibre, experiments leading to discovery of nucleosomal structure, types of histones, arrangement of histones in the octamer, H1 histone and its role, role and length of linker DNA), 30 nm fibers (arrangement of nucleosome in a helical structure), domain and loop structure (further compacting of 30 nm fibre, role of scaffolding proteins). Role of telomere and centromere, telomeric and centromeric repeat sequences.</p>	12

<b>VI</b>	<p><b>Amino acids and Protein Structure</b></p> <p>A) Amino acids: Classification, Properties, reactions (ninhydrin), rare amino acids, and separation techniques</p> <p>B) Primary structure of proteins: peptide bond, use of peptidase specificity, Fibrous proteins, globular proteins.          Secondary structure of proteins: The alpha-helix, Beta-structures (parallel, antiparallel, mixed, beta-turn).          Tertiary structure of proteins: Forces that stabilize the structure (electrostatic forces, hydrogen and disulfide bonds, hydrophobic associations), myoglobin as an example of tertiary structure, concept of domains, protein denaturation.          Quaternary structure of proteins: Forces stabilizing quaternary structure, advantages of oligomeric proteins.</p>	<b>12</b>
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Sr. No.	Practicals (UBT111P)	Minor/Major
1	Introduction to Biotechnology Laboratory setup.	Major
2	Demonstration, use and care of biotechnology equipment	Major
3	Preparation and sterilization of microbial media.	Major
4	Isolation of bacteria and fungi from soil, water, plant and study of their cultural and morphological characteristics.	Major
5	Isolation of Bacteriophage from sewage / other sources.	Major
6	Demonstration of motility of Bacteria	Minor
7	Simple staining of Bacteria.	Minor
8	Gram's staining of Bacteria	Major
9	Endospore staining	Major
10	Demonstration of starch hydrolysis by bacterial cultures.	Minor
11	Fungal spore staining by lactophenol cotton blue method.	Major
12	Estimation of DNA by Diphenylamine method	Major
13	Estimation of RNA by Orcinol method	Major
14	Detection of Amino Acid by paper chromatography	Major
15	Quantitative Estimation of proteins by Biuret method	Major

## Recommended readings:

1. Biotechnology, 5<sup>th</sup> edition, (2013), Singh B.D., Kalyani Publication, Ludhiana.
2. Biotechnology, 4<sup>th</sup> edition, (2013), Satyanarayana U., Chakrapani U., Books and allied (p)
3. Biochemistry, 4<sup>th</sup> edition (2013) Satyanarayana U, Chakrapani U., Elsevier
4. Biotechnology, Fundamentals and applications- S. S. Purohit and S. K. Mathur. Agrobotanica publications. Gene Cloning and DNA analysis. - T. A. Brown. Blackwell Publication
5. Textbook of Microbiology, (2006), Ananthanarayan and Paniker, University Press Publication.
6. General Microbiology, 5<sup>th</sup> edition, (1987), Stanier R.Y., Macmillan Publication, UK.
7. Prescott's Microbiology, 8<sup>th</sup> edition, (2010), Joanne M Willey, Joanne Willey, Linda Sherwood, McGrawHil Science Engineering, USA
8. General Microbiology (Vol.1), (2012), Powar C.B, and Dagainawala H.F., Himalya Publication house.
9. General Microbiology (Vol.2), (2012) Powar C.B, and Dagainawala H.F., Himalya Publication house
10. Textbook of Biochemistry, Satyanarayana U., Books and Allied (P) ltd, Kolkata
11. Lehninger's Principles of Biochemistry, 5<sup>th</sup> edition, (2008), Nelson D. L. and Cox M. M., CBS Publications,
12. Fundamentals of Biochemistry, 3<sup>rd</sup> edition, (2008), Donald Voet and Judith Voet , John Wiley and Sons, Inc. USA
13. Biochemistry and Molecular Biology of Plants, 2<sup>nd</sup> edition, Bob Buchanan et al Wiley
14. Recombinant DNA - Genes and Genomes. - James D. Watson, Any A. candy, Richard M. M, Jan A Witkowski. W.H. Freeman and Company Publication.
15. Principles of Gene manipulation and Genomics. 7<sup>th</sup> edition, (2006), S. B. Primrose and R. M. Twyman. Blackwell Publication
16. Bioinformatics- Principle and application, 1<sup>st</sup> edition, (2008), Gosh Z. and Mallic B., Oxford