BHARATI VIDYAPEETH
(DEEMED TO BE UNIVERSITY), PUNE, INDIA
PhD Entrance Test – 2025
SECTION-II: Biotechnology - 35 Marks

1. **Biochemistry**

   Structure of atoms, molecules and chemical bonds. Structure and function of carbohydrates, proteins, lipids and nucleic acids. Bioenergetics, carbohydrate, lipid, amino acid metabolism. Basic enzymology: enzyme kinetics, enzyme regulation, isozymes.

2. **Cell Biology**

   Prokaryotic and eukaryotic cell structure. Types of eukaryotic cells. Structure and function of various cell organelles, cytoskeleton, cell – cell interactions, cell adhesion molecules, gap junctions, extracellular matrix proteins. Membrane structure and function, transport across membrane. Cell cycle; phases and regulation. Apoptosis, cell death.

3. **Plant and Animal Science**

   Plant physiology; nutrients, phytohormones and their roles, flowering and circadian rhythms, stress physiology (Biotic, water, temperature and salt). Sensory photobiology, solute transport and photoassimilate translocation. Secondary metabolites.

   Animal physiology: cardiovascular system, respiratory system, nervous, excretory and digestive systems, endocrinology and reproduction.

   Genetics and Molecular Biology

   Mendelian principles, concept of gene, organization of genome, mutations: types & causes. Structural and numerical alterations of chromosomes and genetic disorders, DNA replication, repair, prokaryotic and eukaryotic transcription, posttranscriptional processing, translation and post translational processing, regulation of gene expression.

4. **Microbiology**

   Structure, classification and reproduction of bacterial, fungi and viruses. Growth kinetics and nutrition of microbes. Microbial physiology, host microbe interactions, prions, extremophiles. Industrial microbiology. Bioreactors designs, kinetics, rheology, substrates and products, downstream processing, quality control and validation.

5. **Immunology**

   Types of immunity: innate and adaptive. Antibody: structure, classes, genetic basis of diversity. B and T cell epitopes. Antigen antibody interactions. cytokines, complement system, cell mediated effector functions, inflammation, hypersensitivity and autoimmunity, congenital and acquired immunodeficiency.

6. **Methods in Biotechnology**

Isolation and purification of nucleic acids. Techniques of chromatography, centrifugation, electrophoresis, spectroscopy, microscopy. Principles of recombinant DNA technology: generation of genomic and cDNA libraries, different types of vectors, protein and DNA sequencing methods, blotting techniques, RFLP, RAPD and AFLP techniques, Immunochemical techniques.

7. **Applications of Biotechnology**

Selection and improvement of industrially important microorganisms, vaccines and diagnostics, bioremediation, phytoremediation, biosensors, tissue culture methods for plants and animals, Genomics, proteomics, transgenic plants and animals, gene therapy. Plant breeding; methods, marker assisted selection, mutational breeding.

Suggested reading:

1. Nelson and Cox (2008) Principles of Biochemistry by A. Lehninger, W.H. Freeman and Company, New York, USA.
2. Alberts B. and Jhonson A.4th edition (2002) Molecular Biology of the cell, Garland science.
3. Prescott, Harley, and Klein's microbiology by Joanne M. Willey, Linda Sherwood, Christopher J. Woolverton, Lansing M. Prescott (2008) McGraw-Hill Higher Education
4. Brock Biology of Microorganisms Michael T Madigan, John M Martinko, Paul V, 12th Edition (2008) Benjamin Cummings.
5. Cooper G.M. and Hausman R.E. (2004) The Cell: A molecular approach, Sinauer Associates, Inc., ASM Press, Washington DC.
6. Lewin (2007) Genes IX: Pearson Prentice Hall, Pearson Education, Inc. Upper Saddle River, NJ 07458
7. Goldsdy A., Thomus J. K., Barbara A. O. and Kuby J. Immunology
8. Poehlmann M. (1959) Breeding of field crops, Henry Holt and Co., New York.
9. Reinert J.R. and Bajaj Y.P.S.(1997) Applied and fundamental aspects of plant cell, tissue and organ culture. Springer and Verlag, Berlin.
10. Allard R. D. (1999) Princ'iples of Plant Breeding, John Wiley and Sons, Inc.

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