

SYLLABUS

M.Phil./Ph.D Entrance Examination

**Department of Biotechnology
University of North Bengal
SILIGURI-734013**

SYLLABUS

Sl. No.	Paper Name	Name of Course	Marks	
1.	Paper-I	Biotechnology	50	
2.	Paper-II	Research Methodology	50	

Total Marks: 100

Paper I: Biotechnology

Unit I

Biochemistry :Chemical basis of life; Composition of living matter; Water- properties, pH, Buffer, Thermodynamics; Composition, structure and function of biomolecules; Stabilizing interactions;Enzyme catalysis; Bioenergetics-basic principles; Equilibria and concept of free energy; Metabolic pathways;Principles of metabolic regulation

Unit II

Analytical Techniques:UV, Visible and Raman Spectroscopy; Theory and application of Circular Dichroism; Fluorescence; MS, IR and NMR spectroscopy; Chromatographic and Electrophoretic techniques, Radioactive & stable isotopes; Pattern and rate of radioactive decay; Units of radioactivity; Measurement of radioactivity.

Unit –III

Cell Biology:Structure and function of Membrane; Structural organization and function of intracellular organelles;Cell signaling; Regulation of signaling pathways; Light signaling in plants; Bacterial chemotaxis and Quorum sensing; Cell division and cell cycle; Regulation of cell cycle; Cancer:Cancer and the cell cycle, Oncogenes and Tumor suppressor genes, Virus-induced cancer; Apoptosis, Therapeutic interventions of uncontrolled cell growth.

Unit-IV

Molecular Biology: Organization of prokaryotic and eukaryotic genome; DNA methylation & Imprinting; DNA Replication; Repair and recombination;Prokaryotic & Eukaryotic Transcription;Protein synthesis and processing; Post- translational modification of proteins; Mutation and Mutagens; Transposition.

Unit-V

Genetic Engineering: DNA Structure and properties; Tools of Genetic Engineering; Hybridization techniques; DNA-Protein interactions; Cloning and Expression vectors; Shuttle vectors; Insertion of Foreign DNA into Host Cells; Construction of genomic and cDNA libraries;PCR and Its Applications;DNA Sequencing methods; Introduction of DNA into mammalian cells; Gene silencing techniques; Gene knockouts and Gene Therapy.

Unit VI

Genetics:Mendelian principles; Concept of gene; Extensions of Mendelianprinciples; Gene mapping methods; Extra-chromosomal inheritance; Microbial genetics; Human genetics: Pedigree analysis;Quantitative genetics; Mutation: causes and mutant types; Structural and numerical alterations of chromosomes; Recombination: Homologous and non-homologous recombination including transposition.

Unit VII

Immunology: Innate and adaptive immune system, Immunoglobulins: basic structure, classes & subclasses of immunoglobulins;Antigens, antigenicity and immunogenicity;B and T cell epitopes; Antibody diversity; Monoclonal antibodies; Antibodyengineering,MHC molecules, Activation and differentiation of B and T cells; Humoral and cell-

mediated immune responses; Complement system, Toll-like receptors, Cell-mediated effector functions, Inflammation, hypersensitivity and autoimmunity, Immune response during infections, vaccines. Antigen-antibody interactions techniques

Unit VIII

Diversity of Life forms: Principles & methods of taxonomy and evolution; Classical & quantitative methods of taxonomy of plants, animals and microorganisms; Evolutionary relationships among taxa; Levels of structural organization; Microbes and Environment: Role of microorganisms in natural system and artificial system; Influence of Microbes on the Earth's Environment and Inhabitants; Ecological impacts of microbes; Symbiosis (Nitrogen fixation and ruminant symbiosis); Microbes and Nutrient cycles; Microbial communication system; Quorum sensing; Microbial fuel cells; Organisms of health and agricultural importance: Common parasites and pathogens of humans, domestic animals and crops.

Paper 2: Research Methodology

Unit-I Basic Concepts: Research process, problem identification, research designs, informal experimental designs. Completing randomized design, randomized block design, factorial designs.

Unit-II Research Design: Subject of study; Place of study; Reason of such study; Type of data required; Method of data collection; Periods of study; Style of data presentation.

Unit-III

Developing a research plan: Research objective; Informations required for solving the problem; Each major concept should be defined in operational terms; An overall description of the approach should be given and assumption if considered should be clearly mentioned in research plan; Details of techniques to be adopted.

Unit - IV

Sampling and Testing of Hypothesis: Concept of probability, probability distribution, Normal, Poisson, χ -square, t-test. Sampling distribution, central limit theorem, Sandler's A-test, standard error, population mean, sample size, confidence intervals, null hypothesis and alternative hypothesis, level of significance, two tailed and one tailed tests, Z-test, t-test, χ^2 -test, F-test, testing of correlation coefficients, ANOVA one way ANOVA, two way ANOVA Tukey's HSD.

Unit-V

Multivariate Analysis: Multiple regressions, Multiple discriminant analysis, Multiple analysis of variance, Canonical correlation analysis, Factor analysis cluster analysis, Path analysis. Computational techniques.

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