SYLLABUS FOR PH.D. ENTRANCE TEST, 2017-2018

Section-A

RESEARCH METHODOLOGY

1. Methodology of Scientific research; Review of Literature; Formulation of hypothesis; Design of experiments; Collection of data; Interpretation of data.

2. Statistical methods and their significance in scientific research; Probability; Discrete and continuous probability models; Expectation and variance; Central limit theorem; Critical region and error probabilities; Tests for proportion; Equality of proportions; Equality of means of normal populations; Chi-square test for independence; P-value of the statistic; Confidence limits.

3. Theory and application of UV spectroscopy, Circular Dichroism; Fluorescence; MS; NMR; ESR and Plasma Emission spectroscopy; Chromatography Techniques TLC and Paper chromatography; HPLC and FPLC; 2D Electrophoresis

4. PCR principle and applications; Principle of sequencing, Shotgun and BAC to BAC sequencing, EMSA, Cloning, RT-PCR. Nucleic Acid hybridization, Southern and northern blotting.

5. Centrifugation Basic principles; Types of centrifuge - Microcentrifuge; High speed & Ultracentrifuges; Preparative centrifugation; Differential & density gradient centrifugation; Applications (Isolation of cell components); Analytical centrifugation; Determination of molecular weight by sedimentation velocity & sedimentation equilibrium methods


7. Application and principle of ELISA, RIA Immunofluorescence, Hybridoma technology and monoclonal antibody. Western blotting, autoradiography; Radioactivity Radioactive and stable isotopes; Pattern and rate of radioactive decay; Units of radioactivity; Measurement of radioactivity; Geiger-Muller counter; Solid & Liquid scintillation counters (Basic principle; instrumentation & technique);
Section-B

BIOTECHNOLOGY

1. **Cellular & Molecular Biology**: Cell diversity: Chemical equilibrium and energetics; Cell theory; Cell organelles; Cell cycle and cancer biology; Prokaryotic and Eukaryotic transcription; RNA polymerases; Gene expression in bacteria and eukaryotes.

2. **Immunology**: Immunology-fundamental concepts and anatomy of the immune system Components of innate and acquired immunity; Organs and cells of the immune system; Major Histocompatibility Complex - MHC genes; Antigen-antibody interactions; Autoimmunity; Types of autoimmune diseases.

3. **Microbiology & Industrial Applications**: Microbial culture and its characteristics; culture media and its types; Batch culture; fed-batch; continuous kinetics; Host–Pathogen interactions; pathogenicity and virulence; exotoxins and endotoxins; Basic principles in bioprocess technology; Primary and secondary metabolites; Biotechnologically important products.

4. **Genetics & Genetic Engineering**: DNA Structure and properties; Cloning Vectors and methodology; Transduction and Transformation; Types of genetic diseases; Role of genetics in medicine; Complex inheritance-genetic and environmental variation.

5. **Proteins & Enzymes**: Peptides & proteins; Forces stabilizing native protein conformation; Primary, Secondary, Super-secondary, Tertiary and quaternary structure. Enzymes: Features of enzyme catalyzed reaction; Kinetics of single and multi-substrate reactions; Enzyme inhibition.

6. **Genomics & Proteomics**: Introduction Structural organization of genome in Prokaryotes and Eukaryotes; Organelle DNA-mitochondrial; chloroplast; DNA sequencing-principles and translation to large scale projects. Proteomics: Protein analysis; 2-D electrophoresis of proteins; Peptide fingerprinting; LC/MS-MS for identification of proteins and modified proteins; MALDI-TOF; SAGE and Differential display proteomics.

7. **Plant Biotechnology**: Transgenic Plants: Mechanisms of DNA transfer; Viral vectors and their applications. Vector Transformation techniques; Terminator gene technology; Metabolic engineering and industrial products: Plant secondary metabolites; Molecular marker-assisted selection.

8. **Bioprocess Engineering & Technology**: Basic principle of Biochemical Engineering; Isolation; screening and maintenance of industrially important microbes; Concepts of basic mode of fermentation processes Bioreactor designs; Process wastes-whey; molasses; starch substrates and other food wastes for bioconversion to useful products.