

MICROBIOLOGY
Ph.D. Entrance Examination Syllabus - 2020 - 21

PART A
(Research Methodology)

1. Research Methodology: An Introduction: Meaning of Research, Objectives of Research, Motivation in Research, Significance of Research, and Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India.
2. Research Problem and research design: Selecting the Problem, Necessity of Defining the Problem and Technique Involved in Defining a Problem. Research Design Meaning of Research Design, Need for Research Design Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Developing a Research Plan.
3. Sampling: Concepts of Statistical Population, Sample, Sample Survey, Sampling Frame, Sampling Error, Sample Size, Characteristics of a good sample. Probability Sample – Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the sample– Practical considerations in sampling and sample size.
4. Statistical Analysis:- Introduction, significance of statistical methods. Normal distribution. Probability. Degrees of freedom. Measures of variation - standard deviation, Analysis of variance. Standard error. Test for statistical two ways ANOVA and multiple comparison procedures. Significance - students Test, chi-square test.
5. Computer: Its Role in Research: Introduction, The Computer and Computer Technology, The Computer System, Important Characteristics, The Binary Number System, Computer Applications, Use of internet in research.

PART B
(Subject of research-Microbiology)

1. Microbial Genetics and Molecular Biology: Nucleic acids as carriers of genetic information, Structure and functions of nucleic acids, Components of nucleic acids, Double helix, Alternate forms, Denaturation and melting curves. Organisation of Nucleosomes, Superhelicity in DNA, Linking number and topological properties. Types of mutants, biochemical basis of mutation, mutagens, selection and uses of mutagens. Transposable elements, Various repair system for DNA, Transformation, conjugation and transduction in bacteria, Bacterial Plasmids, DNA Replication. Genetic code Transcriptin, Translation and Regulation of Gene Expression: Operon concept. Chromosomes : Condensation of DNA, Loops Domains and Scaffolds. Telomeres. Gene imprinting. Cell Division and Chromosome Segregation . Relationship between DNA replication and cell cycle. Protein trafficking, Signal transduction and Apoptosis.

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2. Biochemistry and Microbial Physiology : Chemistry and Metabolism of macromolecules: Protein, Carbohydrates, Lipids. Photosynthesis: Oxygenic and Anoxygenic photosynthesis Vitamins and their role as coenzymes Respiratory Metabolism, Chemoautotrophy Bioenergetics Enzymes Classification, Enzymes kinetics, Michaelis-Mentonequilibrium for simple enzymes, Enzyme inhibition, Allosteric enzymes, Immobilized enzymes.

3. Bacteria and Cyanobacteria, Viruses, Yeast and Fungi. Bergey's Manual of Systematic Bacteriology, Cyanobacteria and Prochlorophytes, Mycoplasma and Planctomyces, Archaea, Photosynthetic Eubacteria. Chemolithotrophs and Methophyles Gram-negative Aerobic Eubacteria, Enteric Group and Related Eubacteria, Gram-negative Anaerobic Eubacteria, Spirochetes, Rickettsias and Chlamydias, Gram-positive Endospore Forming Bacteria, Gram-positive Nonsporulating Eubacteria, Actinomycetes. Fungi : Significance of Fungi to Human Welfare, Somatic structure, Vegetative growth and Reproduction, Parasexual cycle Classification of fungi, General structure, Life cycle of typical members of Chytridiomycota, Zygomycota, Ascomycota, Deuteromycota, Basidiomycota, Oomycota, Hypochytridiomycota : General Account Slime Moulds Viruses: Brief History of Viruses. Extraction, Purification, Assay of Viruses, Growth and Cultivation of Viruses. Bacteriophages: Lytic and Lysogeny Cycles Classification of viruses. Mechanism of replication of viruses.

4. Immunology: Cells and tissues of immune system. Adaptive and Innate immunity, Cells of immune system, Soluble mediators of immunity, Immune response, Inflammation, Vaccination, Immunopathology. Antigens, Antigen processing and presentation. Immunoglobulins, Structure, Function, Diversity, Antigen-antibody interaction. Major Histocompatibility Complex, T-cell : Ontogeny, T-cell : Receptors, Diversity. B-cell : Ontogeny, Activation, Antibody response in vivo, Differentiation, Cell Mediated Cytotoxicity, Immunological Tolerance, Autoimmunity, Hypersensitive Reactions, Tumour Immunology, Transplantation Immunology. Medical Microbiology: Mechanism of Pathogenesis, Clinical Microbiology, Serological Techniques, Skin and Respiratory System Infections, Alimentary and Urinogenital System Infection, Nervous System: Blood, Wound and Lymphatic System Infection.

5. Fermentation technology: Isolation of industrial strains, preservation of microorganisms, improvement of strains. Microbial growth kinetics, aeration and agitation, sterilization. media for industrial fermentation, development of inoculum. Design and types of fermentor. Instrumentation and control of Fermentation, Downstream processing, Industrial production of SCP, baker's yeast, enzymes, organic acids, polysaccharides, Alcoholic beverages and Antibiotics.