Syllabus for PhD Entrance Examination in Microbiology

Session 2024-25

1.Research Methodology

Concept and formulation of hypothesis, Survey method, Experimental method

Testing of hypothesis. t-test. Chi square test and Analysis of variance.

Collection, presentation and analysis of data

Statistical methods for data analysis; Mean, Standard deviation & standard error.

Concept of probability and its significance.

2. Tools and Techniques in Microbiology

Principle and applications of light, phase contrast and fluorescence, Electron microscopy;SEM & TEM. Chromatography: TLC, ion exchange, affinity, gel filtration, HPLC, Gas Chromatography, Electrophoresis: Principle and applications of paper, gel, SDS polyacrylamide gel electrophoresis. Principle and applications of centrifugation.

3. General Microbiology

Bacteria: Structural organization of bacteria , Gram negative and Gram positive.

Pure culture techniques, culture media, nutritional types.Bacterial growth; kinetics, generation time, asynchronous, synchronous, batch, continuous culture,measurement of growth and factors affecting growth. Control of bacterial growth – physical and chemical agents, preservation methods. Bacterial Staining

Virus: Nomenclature, Classification, Morphology and ultrastructure, Lytic and Lysogenic Cycle.Subviral particles: viroids, virusoids, prions

Fungi: General characteristics, structure and classification,

Asexual and sexual reproduction of fungi, Mycorrhiza

Algae: General characteristics, structure, classification and reproduction, algal pigments.

Economic importance ; SCP, biofuels, food, chemical and pharmaceutically important products

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4. Biochemistry & Metabolism

Structure and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins). Enzyme; general properties and classification, kinetics, enzyme inhibition, Allosteric enzyme.Pathway and regulation of major metabolism - glycolysis (EMP pathway), TCA cycle, glyoxalate cycle, Enter-Daudoroff pathway, pentose phosphate cycle. Electron transport chain and oxidative phosphorylation.Transport across membrane.

5. Genetics & Molecular biology

DNA replication, DNA damage and repair mechanisms. Transcription and translation in prokaryotes post transcriptional modification of mRNA, genetic code, regulation of gene expression ; operon concept, Types of mutation; Physical and chemical mutagens; Bacterial genetic recombination; transformation, conjugation and transduction, plasmids, transposons, RNA interference,

Principles and procedures of protein and nucleic acid sequencing, southern, Northen and western blotting, polymerase chain reaction, RFLP and RAPD, Restriction enzymes. vectors. gene cloning. gene therapy.

6. Immunology

Cells and organs of immune system, antigens, antigenicity and immunogenicity. Structure and function of immunoglobulin. Antigen-antibody interactions, MHC molecules, activation and differentiation of B and T cells, B and T cell receptors, humoral and cell mediated immune responses, , hypersensitivity and autoimmunity.

7. Medical and Diagnostic Microbiology

Microbes host interaction, Diagnosis, prevention and therapy of - meningitis, tuberculosis, leprosy, cholera, syphilis, diphtheria, opportunistic fungal pathogens, dermatophytes, malarial parasite, Giardia and Leishmania,

Types of vaccine: live microorganism, attenuated organism, genetically modified organism, protein, edible, synthetic, recombinant and anti-idiotype vaccine

8. Fermentation Technology & Industrial microbiology

Design and types of Fermenters, types of fermentation process, Down stream processing, concept of industrial microbiology, screening of industrial important microorganism.

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9. Environmental Microbiology

Aero microbiology: Microbes of indoor and outdoor environment, pathways, enumeration, , bioterrorism,

Water microbiology: Significance of microbes in water quality, Test for portability of water, Microbial treatment of sewage: application of wastewater in land.

Soil microbiology: Microbial interaction, Nitrogen fixation, composting of biosolids and domestic solid waste. Biofertilizer and Biopesticide.