

NOTIFICATION (Advt No. 1/2018)

Syllabus (Paper III)

Post Code - 303

Area: Microbiology/Bio-technology

Fundamentals of Microbiology:

Origin and evolution of microbial world: Pathway of discovery of Microbiology, General characteristics of various groups of prokaryotes: bacteria including, Rickettsiae, Chlamydiae, Spirochaetes and Actinomycetes, Cyanobacteria and Mycoplasmas

Eubacteria: cell structure, nutrition, isolation and cultivation, diversity, nutrition, ecology, significance of Gram-positive (Firmicutes, Actinobacteria) and Gram-negative [Proteobacteria (rhizobia, methanotrophs, magnetotactic bacteria), Deinococcus-Thermus, Bacteroidetes]

Classification of Bacteria and Archaea according to the Bergey's Manual of Systematic **Bacteriology**. Numerical taxonomy, phylogenetic analysis, modern methods of studying microbial diversity, microbial culture collections.

Phycology: Algal and Cyanobacterial diversity and distribution, identification, culturing, classification, economic importance and applications, symbiotic associations of algae and fungi

Mycology: Fungal diversity and distribution, identification, cultivation

Microbial physiology: Structure of cell types: prokaryotic & eukaryotic cells, introduction to microbial physiology, The E.coli paradigm, Microbial growth, growth cycle, factors affecting growth, glycolytic pathways, gluconeogenesis, TCA cycle, oxidative phosphorylation.

Metabolism of aromatic compounds, fermentation pathways in specific group of microorganisms, bacterial quorum sensing, Kinetics of microbial growth

Transfer of genetic information in prokaryotes; plasmids, conjugation, transformation, transduction

Techniques and Instrumentation in Microbiology:

Microscopy: Light Microscopy: simple and compound Microscopy, Phase Contrast, Dark field, Confocal, Atomic force and Fluorescent Microscopy; Electron Microscopy: SEM, TEM, AFM sample preparation for microscopy;

Microbial culture techniques: Culture Media- solid and broth, selective, differential and enrichment media, Isolation of bacteria: streak plate method, pour plate method. Culture preservation: refrigeration, freezing, freeze drying (lyophilization) of microorganisms

Chromatographic techniques: Basics of chromatography, Paper, Thin layer and column chromatography, protein purification, liquid chromatography, gas chromatography, affinity chromatography, gel filtration, ion exchange chromatography, HPLC, centrifugation techniques, differential and density-gradient centrifugation, analytical centrifugation and applications, preparative and analytical centrifugation, safety measures of centrifugation

Electrophoretic techniques: Principles of Electrophoresis, Agarose gel electrophoresis, Polyacrylamide gel electrophoresis,

Spectroscopy: Theory and applications, UV-Visible, Fluorescence, IR, FTIR,

Principle of electrochemical techniques, redox reaction measurement, pH meter and electrode, X-ray diffraction

Environmental Microbiology

Principles and methods for collection and preservation of environmental samples for microbiological analysis

Principle and methods for detection of bacteria and phages from different environmental niches

MPN, membrane filtration, indicator bacteria, coliform bacteria, antibiotic sensitivity pattern in polluted environment

Concept of bioremediation- biostimulation, bioaugmentation, biodegradation and biotransformation, biological treatment of wastewater, solid waste management- methane (biogas)

Distribution / diversity of microorganisms in different environments

Transmission of pathogens – bacterial, viral, protozoan, indicator organisms of water, control of microorganisms

Environmental ecology and eutrophication

Industrial Microbiology and Biotechnology:

Definition and scope of industrial microbiology and biotechnology. Basics of Fermentation Technology

Virology:

Animal, viruses/ plant viruses: classification and nomenclature, structure

Bacteriophage: morphology, structure, genome organization and life cycle (lytic and lysogenic) of M13, Mu and Lambda phage.

Biostatistics: Basic concepts of mean, median, mode, Standard deviation and Standard error

Molecular Genetics:

Structure of DNA and RNA

DNA replication: prokaryotic DNA polymerase I, II and III, Eukaryotic DNA polymerase, Okazaki fragments, replication origin, primosomes, concurrent replication mechanism involving leading and lagging strands of DNA, mutations and repair

Transcription: prokaryotic RNA polymerase and sigma factors, prokaryotic and eukaryotic promoters, mechanism of transcription- prokaryotic and eukaryotic, transcription of protein coding genes

Translation: genetic code, ribosome structure, tRNAs, aminoacyl tRNA synthetase, initiation, elongation, termination, translational control

Regulation of gene expression: Prokaryotes: operon concept (lac operon), catabolite repression, transcriptional activators and regulators

An overview of Microbial genomics: Principles of microbial genomics such as sequencing, assembly, annotation of microbial genomes and its application to cultured and uncultured microbial community.

An introduction of functional genomics, different methodologies and techniques of functional genomics such as site-directed mutagenesis, transposon mutagenesis, transcriptomics, proteomics and metabolomics.