

ANDHRA PRADESH

RECRUITMENT OF ASSISTANT PROFESSORS IN THE UNIVERSITY

SYLLABUS FOR THE SCREENING TEST

MICROBIOLOGY SUBJECT CODE - 41

Unit- I

BASICS OF MICROBIOLOGY

History of Microbiology, Basis for the classification of Bacteria-morphological, biochemical, metabolic and molecular criteria. Major Taxonomical groups of bacteria.

MB Diversity: General properties of fungi, Mycoplasma (PPL0), Rickettsia,

Chlamydia, Actinomycetes, Archebacteria (extremophiles) and micro algae.

Sterilization and disinfection – physical and chemical methods. Mode of action of disinfectants.

Methods of testing disinfectants. Isolation of pure cultures. Cultivation of aerobic and anaerobic microbes, Media for growth of microorganisms (bacteria, fungi and algae).

Preservation and maintenance of cultures. Methods of identification of bacteria (Biochemical, Serological and Molecular Methods).

Nutritional groups of bacteria (autotrophy and heterotrophy), Nutritional mutants - auxotrophs and their applications in metabolic studies, Carbon assimilation in bacteria, factors influencing growth (physical and chemical), Batch, synchronous cultures and continuous culture methods. Bacterial growth curve and factors influencing growth. Methods for estimation of bacterial growth.

Unit- II

IMMUNOLOGY

Types, structure and properties of antibodies, Affinity and avidity of antibodies.

Cell types involved in cell mediated immunity. Cell-mediated effector functions Origin, biology and maturation of 'B' and T Lymphocytes (B-dependent and T independent),

Immune response genes and Structure and function of MHC antigens, Role of MHC in controlling the T-cell response, MHC restriction. Triggering of immune response and tolerance Antigen processing and presentation, activation and differentiation of B and T cells, B and T cell receptors,

Humoral and cell-mediated immune responses, primary and secondary immune modulation, clonal selection theory. Cytokines and their role in immune regulation.

Antigen and antibody interactions: Agglutination, precipitation, complement fixation, neutralization.

Antibody mediated type II, anaphylactic reactions, Antibody mediated, type II cytotoxic reactions, Immune complex reactions Type – III, T-cell mediated delayed type hypersensitivity Type-IV, Immunological tolerance and tolerance induction

Unit –III

MEDICAL MICROBIOLOGY

Specimen collection, handling, processing, isolation & Identification of infectious agents from clinical specimens: Urine, Blood, CSF, Sputum, Faeces, Wound/Pus swabs and Genital swabs.

Nosocomial, Water borne and Air borne Infections

Pathology, Laboratory Diagnosis, Epidemiology, Treatment and control of *Staphylococci*, *Streptococci*, *Neisseriae*, *Corynebacterium*, *Bacillus*, *Clostridium*, *Mycobacterium*, *Salmonella*, *Shigella*, *Escherichia*, *Pseudomonas* and *Treponema pallidum*

Mechanisms of Antimicrobial agents:Antibacterial agents: Inhibitors of cell wall synthesis protein synthesis and nucleic acid synthesis. Anti-fungal, Antiviral, Anti parasitic agents, Antimicrobial sensitivity tests, Antimicrobial resistance

Unit IV

MOLECULAR BIOLOGY

Mechanism of genetic transfer in bacteria Transformation, Transduction, conjugation, mapping of bacterial chromosome by transformation, conjugation and Transduction

Replication of DNA, Mechanism and enzymology of replication.

RNA synthesis - (transcription factors and machinery, RNA polymerases, Mechanism of transcription and inhibitors of transcription.

Post transcriptional modifications - Nuclear splicing capping, elongation, and termination, RNA processing, RNA editing, splicing, and polyadenylation, structure and function of different types of RNA, RNA transport

Control of gene expression at transcription and translation level. Regulation of Gene Expression in prokaryotes

Translation: Genetic code deciphering, types of RNA and their role in protein synthesis, structure of ribosomes, aminoacyl tRNA synthetase, mechanism of protein synthesis, translational proof-reading, inhibitors of protein synthesis, post translational modifications. Protein localization and translocation: Structure and function of signal peptide, signal hypothesis and protein trafficking.

UNIT V

VIROLOGY

Properties and classification of RNA & DNA viruses, Principles of virus structure, Replication of viruses- RNA and DNA viruses

Ultra Structure of Plant Viruses (TMV, CMV), Plant virus – cell interaction with reference to TMV and growth cycle

Animal Virus-cell Interactions

Ultra Structure of Animal Viruses (Influenza, SV40, Vaccinia)

Adenovirus, Influenza, Hepatitis B and Vaccinia growth cycles.

Retroviral Multiplication- Structure and replication of cancer viruses eg. Retro-virus with

reference to R S V and Adeno-associated virus.

Methods and techniques used in viral diagnosis Development of Viral Diagnostic kits.

Viral Vaccines and Antiviral Chemotherapeutic agents.

Interferons- induction, types and functions, IFNs as Therapeutics

Unit –VI

GENETIC ENGINEERING

Core techniques of gene manipulation, Construction of c-DNA and genomic libraries. Generation of DNA fragments. Isolation and purification of RNA, DNA (genomic and plasmid), Introduction of cloned genes into host, Screening and detection of recombinant clones – genetic and immunochemical methods

Expression of cloned genes in prokaryotes, Gene expression, factors influencing gene expression of cloned genes. Problems associated with heterologous gene expression

Antisense technology -Gene silencing techniques. Application of recombinant DNA technology in Biology, Agriculture and Medicine.

Unit –VII

INDUSTRIAL MICROBIOLOGY

Types of fermentation processes: surface, solid state, submerged, batch, fed-batch, continuous fermentations. Scale up of fermentation.

Methods for processing intracellular and extracellular products

Cell disruption methods: mechanical and non-mechanical

Enrichment Operations: precipitation methods with salts, organic solvents and polymers; Extractive separations; aqueous two-phase extraction; Counter current, supercritical extraction

Microbial Fermentations

- Antibiotics (B – lactam, tetracycline), Organic acids (citric, lactic acid)
- Amino acids (Lysine & Glutamic acid), Enzymes (Amylases & Proteases)
- Vitamins (Vit-B₁₂ & riboflavin), Alcohol, Acetone, Butanol

Unit –VIII

Microbiology of foods

Microbiology of foods and food safety. Factors affecting the growth of microorganisms in food. Role of microorganisms in fermented foods and food industry. Economically important fermentation products

Food safety and importance of safe food. Factors affecting food safety – Physical, Chemical and Biological. Recent concerns of food safety.

Principles of preservation and spoilage of

- Fish, Poultry and meat products, Milk and Dairy products
- Fruits and vegetables, Cereals and cereal products
- Canning and packaging of foods

Unit –IX

ENVIRONMENTAL MICROBIOLOGY

Microbial leaching of ores- Microorganisms involved in Bioleaching, Chemistry of Bioleaching, Factors affecting bioleaching, Types of leaching with special reference to copper, Uranium and Gold
Bioremediation: Ex-situ and in-situ processes; Intrinsic and engineered bioremediation.

Microorganisms for environmental clean-up of contaminated-Hazardous Waste sites and heavy metal polluted sites.

Degradation of Xenobiotics – Oil Slicks, Detergents, Plastics, Recalcitrance of Pesticides in Soil (eg. DDT). Biopolymers and super bug.

Applications of bioremediation technology: Replacement of petrochemicals, reversal of Global warming.

Fate of engineered microorganisms in the environment.

Marine Microbiology: Microbial biofilms, Marine polysaccharides – biomedical and biotechnological applications.

Biofouling and corrosion: Biofouling organisms, problems due to biofouling, antifouling paints and its environmental pollution, biotechnological approach to biofouling control, aerobic and anaerobic induced corrosion.

Unit –X

MOLECULAR AND IMMUNO DIAGNOSTICS

DNA finger printing techniques and their application, Detection of sequences at the gross level, single nucleotide polymorphisms (SNPs), importance of SNPs, forensic applications of VNTRs RFLP, RAPD, AFLP, *in vitro* mutagenesis and deletion techniques, signature-tagged mutagenesis

Southern blot, Western blot diagnostics, RNA interference and siRNA technology; Micro RNA; gene silencing and applications. Suicide gene therapy, Gene replacement, Gene targeting; Gene Therapy and its applications. Principle and application of gene silencing.

Immuno electrophoresis: rocket immunoelectrophoresis; RIA, Flow cytometry, FACS, ELISA, RIA and immunoblotting. ELISA – Principle, Methodology and applications.

Polyclonal and Monoclonal antibodies Production and applications in diagnosis.

Unit –XI

AGRICULTURAL MICROBIOLOGY

Crop improvement

Genetic Engineering for increasing crop productivity by manipulation of:

Photosynthesis, Nitrogen fixation, Nutrient uptake efficiency

Genetic engineering for biotic stress tolerance: -Insects, fungi, bacteria, viruses, weeds

Genetic engineering for abiotic stress: -Drought, flooding, salt and temperature

Genetic engineering for quality improvement-Protein, lipids, carbohydrates, vitamins & mineral nutrients

Nano technology

Green Synthesis and characterization of metallic nanoparticles using plants and microorganisms

Structural analysis and their applications in agri biotechnology.

Nano fertilizers -A way forward for green economy
Nano biosensors –Next generation diagnostic tools in Agriculture
Development of Nano formulations for crop improvement

Unit –XII

Genomics & Proteomics

Genomics, Transcriptomics, proteomics, metabolomics and omic data bases.

Sequencing by conventional, automated and next generation sequencing approaches-advantages and limitations.

PCR dependent approaches of DNA amplification RFLP, AFLP, T-RFLP, ARDRA, RISA, DGGE/TGGE, Real-time PCR (q-PCR). PCR-independent amplification approaches- Multiple Displacement Amplification (MDA).

Proteomic Tools

Proteome, Functional proteomics, metaproteome. Proteome tools – 2-DE Mass spectrometry analysis MS (ESI-MS/MS) 2-DE/MS, ICAT, Yeast two hybrid analysis; Peptide finger printing

Applications of omic technologies in Bioprospecting