

Syllabus for GATE-XL (Microbiology)

Microbiology

- **Section 1 - Historical Perspective** : Discovery of microbial world; Landmark discoveries relevant to the field of microbiology; Controversy over spontaneous generation; Role of microorganisms in transformation of organic matter and in the causation of diseases.
- **Section 2 - Methods in Microbiology** : Pure culture techniques; Principles of microbial nutrition; Enrichment culture techniques for isolation of microorganisms; antigen and antibody detection methods for microbial diagnosis; Light-, phase contrast-, fluorescence- and electron-microscopy; PCR, real-time PCR for quantitation of microbes; Next generation sequencing technologies in microbiology.
- **Section 3 - Microbial Taxonomy and Diversity** : Bacteria, Archea and their broad classification; Eukaryotic microbes: Yeasts, molds and protozoa; Viruses and their classification; Molecular approaches to microbial taxonomy and phylogeny.
- **Section 4 - Prokaryotic Cells: Structure and Function** : Prokaryotic Cells: cell walls, cell membranes and their biosynthesis, mechanisms of solute transport across membranes, Flagella and Pili, Capsules, Cell inclusions like endospores and gas vesicles; Bacterial locomotion, including positive and negative chemotaxis.
- **Section 5 - Microbial Growth** : Definition of growth; Growth curve; Mathematical expression of exponential growth phase; Measurement of growth and growth yields; Synchronous growth; Continuous culture; Effect of environmental factors on growth; Bacterial biofilm and biofouling.
- **Section 6 - Control of Micro-organisms** : Disinfection and sterilization: principles, methods and assessment of efficacy.
- **Section 7 - Microbial Metabolism** : Energetics: redox reactions and electron carriers; Electron transport and oxidative phosphorylation; An overview of metabolism; Glycolysis; Pentose-phosphate pathway; Entner-Doudoroff pathway; Glyoxalate pathway; The citric acid cycle; Fermentation; Aerobic and anaerobic respiration; Chemolithotrophy; Photosynthesis; Calvin cycle; Biosynthetic pathway for fatty acids synthesis; Common regulatory mechanisms in synthesis of amino acids; Regulation of major metabolic pathways.
- **Section 8 - Microbial Diseases and Host Pathogen Interaction** : Normal microbiota; Classification of infectious diseases; Reservoirs of infection; Nosocomial infection; Opportunistic infections; Emerging infectious diseases; Mechanism of microbial pathogenicity; Nonspecific defense of host;

Antigens and antibodies; Humoral and cell mediated immunity; Vaccines; passive immunization; Immune deficiency; Human diseases caused by viruses, bacteria, and pathogenic fungi.

- **Section 9 - Chemotherapy/Antibiotics** : General characteristics of antimicrobial drugs; Antibiotics: Classification molecular mechanism of mode of action and resistance; Antifungal and antiviral drugs.
- **Section 10 - Microbial Genetics** : Types of mutation; UV and chemical mutagens; Selection of mutants; Ames test for mutagenesis; Bacterial genetic system: transformation, conjugation, transduction, recombination, plasmids, transposons; DNA repair; Regulation of gene expression: repression and induction; Operon model; Bacterial genome with special reference to E.coli; Phage λ and its life cycle; RNA ; mutation in virus genomes, virus recombination and reassortment; Basic concept of microbial genomics.
- **Section 11 - Microbial Ecology** : Microbial interactions; Carbon, sulphur and nitrogen cycles; Soil microorganisms associated with vascular plants; Bioremediation; Uncultivable microorganisms; basic concept of metagenomics and metatranscriptomics.