VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M.Sc. (Part – I) Microbiology

(Effective from June – 2005)

PAPER - I

CELLULAR MICROBIOLOGY AND MICROBIAL DIVERSITY

Unit : 1

Evolution of microbial cell, morphology and ultra structure of prokaryotic cell organelles-cell wall – eubacteria and archaeobacteria, plasma membrane, capsule, flagella, pili and fimbriae, reserve food material.

Biosynthesis of cellular structures.

Unit : 2

Structural and functional features of eukaryotic cell organelles, viz. cell walls, plasma membrane, endoplasmic reticulum, Golgi apparatus, lysosomes, vacuoles, peroxisomes, mitochondria, choroplasts, cytoskeleton, microtubules, nucleus, flagella, cilia.

Unit : 3

Classification of fungi & yeasts-

Division – Chytridiomycota

Division – Zygomycota

Division – Ascomycota

Division – Basidiomycota

Division – Deuteromycota

Unit : 4

Morphology and ultra structure of viruses, Properties of Viruses, Capsids and their arrangements, Types of envelopes and their composition, Viral genome- types and structure, Structure and importance of viroids, Prions.

Classification and nomenclature of Bacterial viruses, Plant viruses and Animal Viruses. Cultivation of bacterial, plant and animal viruses.

Unit : 5

Diversity of Extremophiles and Extreme Environments

Extreme environments

Mechanism of survival, adaptation and diversity of :

- psychrophiles and thermophiles
- acidophiles and alkalophiles
- barophiles, halophiles and osmophilic microbes

Unit : 6

Nomenclature and Taxonomy of bacteria, Concepts and methods of bacterial classification (structural, biochemical and molecular), Phylogenetic relationship of microorganisms, Status of Bergey's manual. Modern approaches in bacterial classification.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M.Sc. (Part – I) Microbiology

PAPER - II

MOLECULAR BIOLOGY & MICROBIAL GENETICS

Unit : 1

Introduction to molecular biology-Central dogma, Forms of DNA and their importance in cell cycle, Structural features of RNAs in relation to their functions, Initiator and Elongator tRNAs, Ribosome binding site on mRNA and corresponding site on rRNA, Petidyl transferase activity of 23S rRNA, Polycistronic and monocystronic RNAs.

Unit : 2

DNA replication in prokaryotic and eucaryotic microorganisms, Topological properties of DNA and mechanism of action of topoisomerases, Replication in single standard DNA, Inhibitors of DNA replication, Isolation of purification of DNA & RNA. Isolation, characterization and biochemical manipulation of genes. Modification of DNA & RNA by enzymes (endo/exo nucleases). RNA synthesis, Inhibitors of RNA synthesis, Control of transcription, Maturation and processing of RNA.

Unit : 3

Genetic Code.
Translation. Post translation modification. Ribosome structure in prokaryote and eukaryote.

Unit : 4

Regulation of gene expression, Positive and negative regulation by induction:Co-repression (*E.coli* : ara-operon & lac-operon), Regulation by attenuation (his and trp-operon), Regulation by small molecules viz: ppGpp and cAMP, Regulation of rRNA and tRNA synthesis. Regulation of ribosome assembly.

Unit : 5

Molecular genetics: Genome organization in bacteria and viruses.
Chromosome structure and functions of bacteria.
DNA – Damage and repair.
Fine structure gene analysis.
Extrachromosomal elements – plasmids and transposons.

Unit : 6

Gene transfer mechanism-Conjugation, transformation, transduction and transfection.
Yeasts and fungal genetics : Tetrad analysis and parasexual cycle.
Genetics of phages viz. T_4, T_7 and Lambda, øX174, MS2.
Genetics of *Streptomyces.*

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M.Sc. (Part – I) Microbiology

PAPER - III

MEDICAL MICROBIOLOGY AND IMMUNOLOGY

Unit :1

Factors involved in Pathogenesis –Establishment, spreading, tissues damage and anti-phagocytic factors.

Mechanism of Pathogenesis-Bacterial adhesion, Colonization and invasion of mucus membranes of respiratory, enteric and urogenital tract, Role of aggressins, Depolymerizing enzymes, Cell tropisms.

Unit : 2

Bacterial Pathogenesis :- *Staphylococci, Streptococcus, Neisseria, Clostridium*, Enteric bacteria, *Vibrio, Mycobacterium*.

Basic concept of fungal diseases.

Viral Pathogens – Herpes, Picorna, Rhabdo, Hepatitis, HIV.

Unit : 3

Molecular diagnosis of diseases. Various methods of drug susceptibility testing. Types of vaccines and their schedules. Passive prophylactic measures. Recombinant vaccines. Prebiotic, Probiotics and Synbiotics.

Unit : 4

Immune system, Innate and adaptive immunity.

Humoral and Cell mediated immune responses. Activation of T and B lymphocytes. Cytokines and their role. Autoimmunity – Theory and mechanism.

Unit : 5

Brief overview of antigens. Epitopes. Immunoglobulins – structure and functions. Complement system.

Immunological reactions : In-vitro agglutinations, Precipitations, Immuno fluoroscence, ELISA, RIA. In-vivo method, skin test, lymphokines and cytokines and their assay methods.

Unit : 6

Structure and functions of MHC and HLA system. Gene regulation and IR genes. HLA system and tissue transplantation – Host reactions and rejection. Tumor specific antigens. Immune response to tumors. Immunodiagnosis of tumors – detection of tumor markers – α- foetal proteins, carcinoembryonic antigens.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M.Sc. (Part – I) Microbiology

PAPER - IV

ENVIRONMENTAL MICROBIOLOGY

Unit :1

Microbes and environment. Microbial diversity – Basic concept.
Global Environmental Problem. Positive and Negative role of microbes in environment. Microbes and Biogeochemical cycles: Carbon, Nitrogen, Phosphorus, Sulfur, Biological N_2 fixation : Structure, function and genetic regulation of nitrogenases.

Unit : 2

Water Pollution: Physical ,chemical, biological and its consequences.
Eutrophication and its control.
Air pollution
Land pollution: Biodegradation of recalcitrant compounds, lignin, pesticides and their applications.

Unit : 3

Wastewater characterization, COD, BOD, Inorganic constituents, solids, biological compounds. Wastewater management. Principles and aims of waste water management. Biochemistry and Aerobic and anaerobic waste water treatment methods.
Solid waste management. Management of biomedical and radioactive wastes.

Unit : 4

Microbial diversity – Basic concept. Marine, Desert, Extreme environment.
Water ecosystem. Types-fresh water, marine, estuaries, mangroves, deep sea, hydrothermal vents, saltpans, coral reefs.
Zonation of water ecosystems, upwelling.
Microbiological analysis of marine water.

Unit : 5

Environmental biotechnology- Bioremediation: Oil spills, metals and other hazardous waste.
Bioremediation of contaminated water and soil by the use of GMO.
Introduction to Bioprospecting. Approaches for Bioprospecting.
Bioleaching of metals.
Biomagnification, Biofilms and applications.

Unit : 6

Biodegradation of xenobiotic compounds, aliphatic and aromatic compounds, polydromic and halogenated hydrocarbons, pesticides, dyes.
Biodeterioration of metals, pharmaceuticals, wood, leather, textiles.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M.Sc. (Part – I) Microbiology

PRACTICALS

1. Isolation and examination of Cyanobacteria and Fungi. (by phase contrast microscopy).

2. Microbial growth measurement. Methods for –
   Cell Mass
   Cell Number

3. Effect of environmental factors on growth curve (pH, temperature, nutrients)

4. One step growth curve of phage.

5. Cultivation of animal viruses by chick-embryo technique.

6. Transformation of *E. coli / B. subtilis.*

7. Drug susceptibility testing and determination of MIC and MBC.

8. Study of pathogenic bacteria from clinical specimens.
   (i) Stool culture
   (ii) Urine culture
   (iii) Throat swab culture
   (iv) Sputum culture

9. To study physical, chemical and biological characters of water and domestic and industrial wastewater.
   (i) TDS
   (ii) TSS
   (iii) SVI
   (iv) Acidity / Alkalinity
   (v) Hardness
   (vi) Residual Chlorine
   (vii) B.O.D.

10. Bioremediation (Heavy metal adsorption)

11. Induction of mutants by Chemical agent.

12. Induction of mutants by Radiation UV/IR.

13. Slide culture of fungi. Sexual / Asexual spore production study.

14. To study the polyploidy in fungi.