

## **MSC -MICROBIOLOGY- IV- Semester Syllabus**

### **MB: 401 - AGRICULTURE MICROBIOLOGY**

#### **UNIT I**

1. Microorganisms of soil
2. Rhizosphere and phyllospheremicroflora
3. Brief account of Microbial interactions: antagonism, symbiosis, mutualism, commensalisms, synergism and parasitism.
4. Nutrient cycle: Carbon cycle, nitrogen cycle, phosphorous cycle and sulphur cycle.

#### **UNIT II**

1. Role of enzymes and toxins in pathogenesis.
2. Fungal diseases of plants: Rusts of wheat, linseeds; late blight of potato; red rot of sugarcane.
3. Bacterial diseases of plants : Citrus canker, blight of rice
4. Viral diseases of plants: Leaf curl of Papaya, vein clearing of lady's finger

#### **UNIT III**

1. Physical and chemical control of plant diseases.
2. Bacterial control of insect pests: *Bacillus thuringiensis* as bacterial insecticide
3. Viral control of insect pests: Nuclear polyhedrosis viruses (NPV) and cytoplasmic polyhedrosis viruses (CPV)
4. Fungal control of insect pests: Entomopathogenic fungi : *Metarhiziumanisopliae*, *Beauveria bassiana*, *Verticillium lecani*, *Hirsutiella thompsoni*

#### **UNIT IV**

1. Storage fungi: Categories of storage fungi, conditions during storage in relation to damage of seeds, harmful effects.
2. Mycotoxins and their effect on human being.
3. General idea about quarantine.
4. Production of biogas and alcohol from agricultural wastes.

#### **UNIT V**

1. Biofertilizers: Types, production and application.
2. Mycorrhizae: Types and their application in agriculture and forestry.
3. Vermicomposting.
4. Reclamation of waste agricultural land by microorganisms.

#### **Reference Books**

1. Soil Microbiology by Prof. N.S. Subba Rao, Fourth edition, Oxford and IBH Publishing CO. PVT., LTD., New Delhi
2. Introduction to soil microbiology. Alexander M. (1977) John Wiley & Sons, Inc., New York.
3. Modern Soil Microbiology, Dirk J, Elias V, Trevors JT, Wellington, EMH (1997) Marcel Dekker INC, New York.

## **MB: 402- FOOD MICROBIOLOGY**

### **UNIT I**

1. Microorganisms important in food microbiology: molds, yeast and bacteria –general characteristics, classification and importance.
2. Principles of food preservation, preservation by use of high temperature, low temperature, drying and desiccation.
3. Chemical preservatives and additives.
4. Preservation by radiation.

### **UNIT II**

1. Factors influencing microbial growth in food: Extrinsic and intrinsic factors.
2. Microbial spoilage of food. Chemical changes caused by the microorganisms during spoilage.
3. Spoilage of fish, meat, poultry, eggs, fruits and vegetables.
4. Detection of spoilage and characterization.

### **UNIT III**

1. Classification of food borne diseases.
2. Food borne infections: *Brucella*, *Bacillus cereus*, *Clostridium perfringens*, *Yersinia enterocolitica* and *Escherichia*, *Salmonella* spp.
3. Food intoxication: Staphylococcal intoxication, Clostridial poisoning (*Clostridium Botulinum*).
4. Food adulteration and prevailing food standards in India.

### **UNIT IV**

1. Microbiology of Milk: Sources of microorganisms in milk and types of microorganisms in milk.
2. Microbiological examination of milk (standard plate count, direct microscopic count, reductase, and phosphatase test).
3. Dehydration and pasteurization of milk.
4. Dairy products from microorganisms: Butter, yoghurt and cheese.

### **UNIT V**

1. Microorganisms as source of food: Single Cell Protein (SCP)
2. Mushrooms and food value of mushrooms
3. Food conversions: Lactic acid conversions, soyabean conversions and Bakery
4. Microbiological estimation of food: Sample collection, preparation and analysis techniques

### **Reference Books**

1. Food science By Norman N. Potler, Joseph H. Hotchkiss. Fourth edition, CBS Publishers and Distributors, New Delhi
2. Food Microbiology, by William C. Frazier and Dennis C. Westhoff, Fourth edition, Tata McGraw-Hill Publishing Company Limited, New Delhi
3. Modern Food Microbiology by James M. Jay, Fourth Edition, CBS Publishers and Distributors, New Delhi.

**MB: 403(A)- VIROLOGY AND MYCOLOGY**

**UNIT-I**

1. Brief outline on discovery and origin of viruses.
2. General properties of viruses, morphology and ultra-structure of viruses, capsid and their arrangements, types of envelopes and their composition, measurement of viruses.
3. Viral genome; their types and structure, viral related agents-viroids and prions.
4. Classification and general properties of major families of viruses including detail account of their mode of replication.

**UNIT-II**

1. Cultivation of viruses- in embryonated eggs, experimental animals and cell lines; primary and secondary cell lines, diploid cell culture.
2. Assay of viruses: physical and chemical methods, plaque method, pock counting and end point method.
3. Serological methods: hemagglutination, hemagglutination inhibition, neutralization test, complement fixation, ELISA, RIA.
4. Purification of viruses: gradient centrifuge, electrophoresis, and chromatography.

**UNIT-III**

1. Plant viruses: recent advance in classification of plant viruses. Structure and pathogenicity of TMV.
2. Transmission of plant viruses with vector (insect, nematodes and fungi) and without vector (contact, seed and pollens). Biochemical changes induced by virus in plant cell.
3. Animal viruses: nomenclature and classification of animal viruses.
4. General idea about Cyanophage, and Mycophage.

**UNIT-IV**

1. Bacteriophage: classification, morphology and ultrastructure.
2. One step growth curve (latent period, eclipse period, and burst of size.)
3. Life cycle: lytic and lysogenic life cycle of bacteriophages.
4. Brief account of M13, Mu, T4,  $\phi$  x174 and lambda phage

**UNIT-V**

1. Structure, reproduction and classification of fungi, general characteristics of Zygomycetes, Ascomycetes, Basidiomycetes, and Deuteromycetes.
2. Cultivation of fungi, culture media for fungal growth, effects of environment on growth, isolation, identification and preservation of fungi.
3. Dimorphic fungi, yeast morphology, general characteristics and reproduction. Lichens, Mycorrhiza, and Actinomycetes.
4. Ecology of fungi: concept of fungistatic, fungicidal.

**Reference Books**

1. Virology; Renato Dulbecco and Harold S. Ginsberg, Fourth edition, J.B. Lippincott Company, USA
2. An Introduction to viruses, S. B. Biswas and Amita Biswas. Forth edition, Vikas Publishing House PVT LTD New Delhi.
3. Textbook of Microbiology by Ananthnarayanan and Paniker's, eighth edition, Universities Press.

**MB: 403(B)MICROBIAL IMMUNOLOGY**

**UNIT-I**

1. History of immunology, development of immunology as discipline.
2. Immune response: mechanism of innate and adaptive immune response.
3. Hematopoiesis: development of immune cells, regulation of hematopoiesis.
4. Structure, composition and types of cells involved in immune response: mononuclear cells, granulocytes, antigen presenting cells, lymphoid cells. Mediators and process of inflammation.

**UNIT-II**

1. Anatomical organization of immune system: primary and secondary lymphoid organs: structure and function.
2. Antigens-structure and properties, factors affecting the immunogenicity, properties of B and T-cell epitopes, haptens, mitogens, super antigen, adjuvants.
3. Antibody: structure, properties, types and function of antibodies, antigenic determinants on immunoglobulin; isotypes, allotypes, and idiotypes, molecular mechanism of antibody diversity and class switching.
4. Cell mediated immunity and its mechanism.

**UNIT-III**

1. Major histocompatibility complex: organization of MHC genes, types and function of MHC molecules, antigen presentation, MHC polymorphism, MHC related diseases.
2. Complement system: components, activation pathways, regulation of activation pathways and role of complement system in immune response.
3. Cytokines: types, structure and functions, cytokine receptors, cytokine regulation of immune receptors.
4. Immune response to infectious diseases: viral infection, bacterial infection, protozoan diseases, helminth related diseases.

**UNIT-IV**

1. Hypersensitivity: type I, II, III and types IV hypersensitivity. Immunodeficiency diseases: primary and secondary immunodeficiency.
2. Autoimmunity: organ specific autoimmune diseases, mechanism of autoimmune diseases and therapeutic approaches.
3. Transplantation immunology: immunologic basis of graft rejection, clinical manifestation of graft rejection and clinical transplantation.
4. Cancer immunology: tumor antigen, immune response to tumor, oncogene and induction, cancer immunotherapy.

**UNIT-V**

1. Vaccines: Active and passive immunization, vaccine schedule, whole organism vaccine, subunit vaccine, DNA vaccine, recombinant vaccine, subunit vaccines and anti-idiotypic vaccine.
2. Hybridoma technology: murine monoclonal antibody production, principle of selection, characterization and applications in diagnosis, therapy and basic research.
3. Antibody engineering: Chimeric and Humanized monoclonal antibodies.
4. Antigen- antibody interaction: avidity and affinity measurements, detection of antigen- antibody interaction by precipitation, agglutination, RIA, and ELISA.

**Reference Books**

1. Kuby Immunology by Kindt TJ, Goldsby RA, Osborne BA, Kuby J: 6th edition. New York. WH Freeman;2006.
2. Cellular and Molecular Immunology by Abbas AK, Lichtman AH, Pillai S: Saunders Elsevier; 2007.
3. Immunobiology: The immune system in health and disease by JanewayCA, TraversP, Walport M, Shlomchik MJ: 6th edition. New York. Garland Science Publishing;2005.
4. Medical Microbiology and Immunology by Levinson W, Jawetz E: Lange publication;2001.

**PRACTICALS**

**MB: 404- Lab-I**

1. To study viral diseases in plants.
2. To study bacterial and fungal diseases in plants.
3. Isolation of rhizobia from root nodules of leguminous plants.
4. Testing of nodulation ability of rhizobia.
5. Inoculation of seeds with rhizobia.
6. To study pesticidal activity of *Bacillus thuringiensis*.
7. Isolation of VAM spores from soil.
8. Isolation of *Azotobacter* species from soil.
9. Isolation of microorganisms from rhizosphere.

**MB: 405 Lab II**

1. Detection of adulterants in spices, pulses, sugar, tea.
2. Detection of adulterants in milk and milk products.
3. Detection of arsenic by microbiological methods.
4. Detection of nicotinic acid by bioassay.
5. Detection of number of bacteria in milk by SPC.
6. Determination of quality of milk sample by methylene blue reduction test.
7. To demonstrate role of yeast in bread-making.
8. Isolation of microorganisms from spoiled food.
9. Isolation of pathogenic microorganisms from food.