|| Jai Sri Gurudev ||

Adichunchanagiri School of Natural Sciences

Adichunchanagiri University

Adichunchanagiri School of Natural Sciences

M.Sc MICROBIOLOGY SYLLABUS

Course Description

1. Demonstrate theory and practical skills in microscopy and their handling techniques and staining procedures
2. Understand the basic microbial structure and function and study the comparative characteristics of prokaryotes and eukaryotes and also Understand the structural similarities and differences among various physiological groups of bacteria/archaea
3. Know various Culture media and their applications and also understand various physical and chemical means of sterilization
4. Know General bacteriology and microbial techniques for isolation of pure cultures of bacteria, fungi and algae
5. Master aseptic techniques and be able to perform routine culture handling tasks safely and effectively
6. Comprehend the various methods for identification of unknown microorganisms
7. Understand the microbial transport systems and the modes and mechanisms of energy conservation in microbial metabolism – Autotrophy and heterotrophy
8. Know the various Physical and Chemical growth requirements of bacteria and get equipped with various methods of bacterial growth measurement

2023-24

Adichunchanagiri University

B.G. Nagara - 571 448, Nagamangala Taluk, Mandya District, Karnataka, India.

Adichunchanagiri University

Syllabus for
M. Sc. Microbiology
Choice Based Credit System (CBCS)

From the Academic Year

2023 - 2024

Adichunchanagiri University

B.G. Nagara - 571 448, Nagamangala Taluk, Mandya District, Karnataka, India.

Name of the Course	**:**	M. Sc. Microbiology
Duration of the course	**:**	Two years (Four Semesters)
Eligibility	**:**	Candidates must have secured 45% (40% for SC/ST) in aggregate with Microbiology / Botany / Zoology / Molecular Biology as one of the cognate subjects at B.Sc., level.
Intake	**:**	29 seats
Admission	**:**	As per the prevailing University regulations.

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The Choice Based Credit System (CBCS) comprises Hard Core, Soft Core subjects for Nanoscience Students and Open Elective for students other than Nanoscience. Following shall be the minimum and maximum subjects per semester.

The credit pattern is Lecture (L); Tutorial (T); Practical (P); (L:T:P) Pattern.

Lecture: One-hour session of theory class per week in a semester is 1 credit.

Tutorial and Practical: Two-hour session of tutorial or practical per week in a semester is 1 credit.

One semester period is **16 weeks** of teaching and learning.

Duration of semester is **20 weeks** that includes semester end examinations.

Credit Distribution:

Course Type	Credits
Hard Core	Minimum Credits - 48 and Maximum Credits - 56
Soft Core	Minimum Credits - 16
Open Elective	Minimum Credits - 8

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Microbiology

B.G. Nagara - 571 448, Nagamangala Taluk, Mandya District, Karnataka, India.

SCHEME OF STUDY AND EXAMINATION
I to IV SEMESTER M. Sc. MICROBIOLOGY COURSE

Sl. No.	Semester	HCT	SCT	HCP	OE	Credits
1	Semester I	3	2	2	—	24
2	Semester II	3	2	2	—	24
3	Semester III	3	2	2	—	24
4	Semester IV	Complete semester is dedicated for Major project (MAP)			2	16
					Total	**88**

HCT = Hard Core Theory = Credits 4

SCT = Soft Core Theory = Credits 3

HCP = Hard Core Practical = Credits 2

OE = Open Elective = Credits 2

MAP = Major Project = Credits 8

Sl. No.	Course	L	T	P	[(No. of theory × (L+T)] + (No. of practical × P) + project work	Credits
1	Hard Core	3	1	2	(9×4) + (6×2) + 8	56
2	Soft Core	3	1	—	6×4	24
3	Open Elective	3	1	—	2×4	08
					Total	**88**

Adichunchanagiri University

Microbiology

First Semester

Paper Code	HC/SC	T/P	Title of the Paper	Teaching hours /week	Exam hours	Marks			Credits
						IA	Exam	Total	
22MHCT101	HC	T	Fundamentals of Microbiology & Bacteriology	3+1	3	40	60	100	4
22MHCT102	HC	T	Virology & Mycology	3+1	3	40	60	100	4
22MHCT103	HC	T	Microbial Physiology & Enzymology	3+1	3	40	60	100	4
Choose two among the three Soft Core subjects									
22MSCT104	SC	T	Microbial Ecology & Biodiversity	3+1	3	40	60	100	4
22MSCT105	SC	T	Techniques in Microbiology	3+1	3	40	60		
22MSCT106	SC	T	Applied Microbiology	3+1	3	40	60	100	4
22MHCP107	HC	P	Practical I	4	6	20	40	50	2
22MSCP108	HC	P	Practical II	4	6	20	40	50	2
							Total	**600**	**24**

Second Semester

Paper Code	HC/SC	T/P	Title of the Paper	Teaching hours /week	Exam hours	Marks			Credits
						IA	Exam	Total	
22MHCT201	HC	T	Microbial Genetics	3+1	3	40	60	100	4
22MHCT202	HC	T	Immunology	3+1	3	40	60	100	4
22MHCT203	HC	T	Molecular Biology	3+1	3	40	60	100	4
Choose two among the three Soft Core subjects									
22MSCT204	SC	T	Genetic Engineering	3+1	3	40	60	100	4
22MSCT205	SC	T	Environmental Microbiology	3+1	3	40	60		
22MSCT206	SC	T	Biochemistry & Microbial Metabolism	3+1	3	40	60	100	4
22MHCP207	HC	P	Practical III	4	6	20	40	50	2
22MSCP208	HC	P	Practical IV	4	6	20	40	50	2
							Total	**600**	**24**

Third Semester

Paper Code	HC/SC	T/P	Title of the Paper	Teaching hours /week	Exam hours	Marks			Credits
						IA	Exam	Total	

22MHCT301	HC	T	Medical Microbiology	3+1	3	40	60	100	4
22MHCT302	HC	T	Food Microbiology & Dairy Microbiology	3+1	3	40	60	100	4
22MHCT303	HC	T	Industrial Microbiology	3+1	3	40	60	100	4
Choose two among the three Soft Core subjects									
22MSCT304	SC	T	Agricultural Microbiology	3+1	3	40	60	100 100	4 4
22MSCT305	SC	T	Clinical & diagnostic microbiology	3+1	3	40	60		
22MSCT306	SC	T	Soil Microbiology	3+1	3	40	60		
22MHCP307	HC	P	Practical V	4	6	20	40	50	2
22MSCP308	HC	P	Practical VI	4	6	20	40	50	2
							Total	**600**	**24**

Fourth Semester

Paper Code	**HC/SC**	**T/P**	**Title of the Paper**	**Teaching hours /week**	**Exam hours**	**Marks**			**Credits**
						IA	**Exam**	**Total**	
22MOET401	OE	T	Research Methodology	3+1	3	40	60	100	4
22MOET402	OE	T	SWAYAM/MOOC	4	3	-	100	100	4
22MOET402	OE	T	Molecular Biotechnology	3+1	3	40	60	100	Optional 4
22MMAP403	HC	PR	Major Project			50	150	200	8
							Total	**400**	**16**

Adichunchanagiri University

Hard Core Subjects

Sl. No.	Paper Code	T/P	Title of the Paper	Credits
1	22MHCT101	T	Fundamentals of Microbiology & Bacteriology	4
2	22MHCT102	T	Virology & Mycology	4
3	22MHCT103	T	Microbial Physiology & Enzymology	4
4	22MHCP107	P	Practical I	2
5	22MSCP108	P	Practical II	2
6	22MHCT201	T	Microbial Genetics	4
7	22MHCT202	T	Immunology	4
8	22MHCT203	T	Molecular Biology	4
9	22MHCP207	P	Practical III	2
10	22MSCP208	P	Practical IV	2
11	22MHCT301	T	Medical Microbiology & Diagnosis	4
12	22MHCT302	T	Food Microbiology & Dairy Microbiology	4
13	22MHCT303	T	Industrial Microbiology	4
14	22MHCP307	P	Practical V	2
15	22MSCP308	P	Practical VI	2
16	22MMAP403	P	Major Project	8
			Total	**56**

Soft Core Subjects

Sl. No.	Paper Code	T/P	Title of the Paper **Select any two (20MSCT104, 20MSCT105 & 20MSCT106)** **Select any two (20MSCT204, 20MSCT205 & 20MSCT206)** **Select any two (20MSCT304, 20MSCT305 & 20MSCT306)**	Credits
1	22MSCT104	T	Microbial Ecology & Biodiversity	4
2	22MSCT105	T	Techniques in Microbiology	
3	22MSCT106	T	Applied Microbiology	4
4	22MSCT204	T	Genetic Engineering	4
5	22MSCT205	T	Environmental Microbiology	
6	22MSCT206	T	Biochemistry & Microbial Metabolism	4
7	22MSCT304	T	Agricultural Microbiology	4
8	22MSCT305	T	Soil Microbiology	
9	22MSCT306	T	Aero Microbiology	4
			2Total	**24**

Open Electives Subjects

Sl. No.	Paper Code	T/P	Title of the Paper	Credits
1	22MOET401	T	Fundamentals of Microbiology	4
2	22MOET402	T	Molecular Biotechnology	4
			Total	**8**

Semester I

22MHCT101: Fundamentals of Microbiology and Bacteriology (Hard Core)

Course Objective:

1. To learn about basics of microbiology important discoveries, classification and basics of bacterialogy,

Course outcome:

1. Basics about bacterial culture methods
2. Growth techniques of various bacteria

Unit I **16 hrs.**

History of microbiology: Origin, development and scope of microbiology. Theories of spontaneous generation. Biogenesis and germ theory of disease. Contributions of scientists - Antony van Leeuwenhoek, Louis Pasteur, Robert Koch, Paul Ehrlich, Alexander Fleming, Edward Jenner and Joseph Lister.

Microorganisms: Major groups of microorganisms. General characteristics of major groups of microorganisms. Prokaryotes and Eukaryotes - viruses, bacteria, fungi, algae and protozoa. A comparative account of prokaryotes and eukaryotes. General structure and functions of cell membrane, membrane bound organelles and cell organelles. Distribution of microorganisms:

Unit II **12 hrs.**

Microscopy: Working principle, construction and operation of different types- simple, compound, Phase contrast, Fluorescent and Electron microscopes. Micrometry and photomicrography.

Unit III **18 hrs.**

Morphology and ultrastructure of bacteria: An overview of bacterial size, shape and arrangement, bacterial cell wall, plasma membrane, internal membrane systems, cytoplasmic matrix, nucleoid, inclusion bodies, ribosomes, flagella and pili. Bacterial motility and endospore.

Characteristics and salient features of major groups of microbes: Taxonomy of bacteria - Bergy's manual of systematic bacteriology - characteristics of major groups of bacteria.

a) Actinomycetes - general characteristics, classification and economic importance.

b) Cyanobacteria - general characteristics, classification, ultrastructure, reproduction and economic importance.

c) Mycoplasma - general characteristics and examples, growth and multiplication and their significance.

d) Archaebacteria - general characteristics and classification.

Unit IV **18 hrs.**

Microbial growth and cultivation of bacteria: Cell growth and binary fission, growth of bacterial population-growth cycle, growth kinetics, generation time. Measuring microbial growth-direct and indirect measurements of microbial growth. Aerobic, anaerobic, batch, continuous cultivation and synchronous cultures.

Preparation of bacterial stains: simple staining (positive and negative), differential staining (Gram's staining and acid-fast staining), structural staining (capsule, flagella and endospore) and nuclear staining.

22MHCT102: Virology and Mycology

(Hard Core)

Total number of lecture hours: 64 **Total number of credits: 04**

Course objectives:

1. To learn viral and fungal infections
2. To understand viral and bacterial structures, replication and detection methods.

Course outcomes:

1. Learn about the history of viruses and fungi.
2. Learn about importance of the viruses and fungi
3. Isolation, cultivation and identification of various viruses and fungi.

Unit I **16 hrs**

Virology: History, discovery, origin, development and evolution of viruses. Definitive properties of viruses: Morphology, ultra-structure. Evolutionary importance of viruses. Working with viruses: Visualization and enumeration of virus particles. Isolation and purification of viruses. Detection of viruses: physical, biological, immunological and molecular methods.

Phages: Bacteriophages, cyanophages, mycophages and phycophages - General characteristics, isolation, identification and cultivation, replication of phages.

Unit II **20 hrs.**

Plant viruses: General characteristics. Isolation, identification, cultivation and classification. Different modes of transmission of plant viruses. Structure and life cycle of some important plant viruses. Type studies and significance of plant viruses.

Animal viruses: General characteristics. Isolation, identification and cultivation and classification. Dissemination of animal viruses - direct and indirect contacts, through vectors. Structure and life cycle of some of the important animal viruses. Type studies and significance of animal viruses.

Viruses and the future: Promises and problems. Emerging diseases, sources and causes of emergent virus diseases. Influenza and SARS-COV-2.

Unit III **16 hrs.**

Introduction: History and development of mycology, scope of mycology. Recent developments in mycology.

Fungal taxonomy: Taxonomic problems associated with variation in fungi. Classification of fungi (Alexopoulos and Mims). General characteristics of fungi and reproduction: Morphology and somatic structures: Thanllus, organization, ultra-structure of fungal cell, nuclear components, specialized somatic structures.

Unit IV **12 hrs.**

Salient features of fungal major groups: Basidiomycota, Ascomycota, Deuteromycota, Oomycota, Hypochytriomycota, Labyrinthulomycota, Plasmodiophoromycota and Myxomycota. Symbiotic fungi- Lichens.

Economic importance of fungi: Fungi as biocontrol agent, importance of Fungi in agriculture, industry and medicine. Fungi as SCP, Fungi as parasites of human and plants.

22MHCT103: Microbial Physiology and Enzymology

(Hard Core)

Total number of lecture hours: 64 **Total number of credits: 04**

Course objective:

To learn basic metabolism and cellular physiology in microbes.

Course outcomes:

1. Fundamentals of microbial metabolism, physiology
2. Nitrogen metabolism and photosynthesis in microbes.
3. Enzymology of microbes which are involved in fermentation and production of various metabolic products.

Unit I

Microbial physiology: Microbial energetics, The role of ATP in metabolism. Metabolism of Carbohydrate: Glycolysis, citric acid cycle and oxidative level phosphorylation, fates of pyruvate, fermentation. Utilization of sugars other than glucose: lactose, galactose, maltose, mannitol. Degradation of cellulose, starch and glycogen.

16 hrs.

Unit II

Nitrogen metabolism: Nitrogen metabolism, biological nitrogen fixation process, symbiotic and non-symbiotic nitrogen fixation. urea cycle.

Unit III **18 hrs.**

Microbial photosynthesis: Light energy, photolysis of water, photosynthetic pigments, cyclic and non-cyclic photophosphorylation, Calvin's cycle.

Autotrophic mechanisms in bacteria: Hydrogen bacteria, nitrifying bacteria, sulfur bacteria, iron bacteria, methylotrophs.

Microbial Stress Responses: Oxidative stress, thermal stress, starvation stress, aerobic to anaerobic transitions.

Unit IV **16 hrs.**

Microbial enzymes: Structure and classification, mechanism of enzyme actions: lock and key model, induced fit theory. Factors affecting enzyme activity - pH, temperature and substrate and enzyme concentration. Enzyme inhibition and enzyme regulation. Significance and applications of enzyme inhibitors.

Isoenzymes (Isozymes): Definition and significance of isoenzymes. Examples and applications of important isoenzymes - Lactate dehydrogenase, creatine phosphokinase, alcohol dehydrogenase, alkaline phosphatase and isocitrate dehydrogenase.

Isolation and purification of microbial enzymes.

22MSCT104: Microbial Ecology and Biodiversity

(Soft Core)

Total number of lecture hours: 64 **Total number of credits: 04**

Course objective:
To learn about the importance of microorganisms in the ecosystem.
Course outcomes:

1. Learn about the interaction of microorganism with plants and animals in the ecosystem
2. Learn about the microorganisms in the marine ecosystem, soil ecosystem

Unit I **16 hrs.**

Introduction to microbial ecology: Overview, interactions of microorganisms with their physical and chemical environment. Microbial guilds and biogeochemical cycles. Interactions with the biotic environment: symbiosis, competition, parasitism, predation. Interactions within microbial communities: Interactions of microorganisms with animals and humans.

Unit II **16 hrs.**

Marine ecosystems: Ocean surface, tidal flats, deep-sea, methane seeps, estuaries, anoxic basins. Freshwater ecosystems: lakes, rivers, swamps and bogs. Terrestrial ecosystems: rocks and soil, prairie, forest and tundra. Extreme environments: deserts, hot springs, glaciers, deep subsurface.

Unit III **16 hrs.**

Bacterial Diversity: Archaebacteria, photosynthetic eubacteria, chemoautotrophic and methophilic eubacteria, gliding eubacteria, Spirochetes, Rickettsiae and Chlamydiae, Actinomycetes, Mollicutes, Protists. Classification based on Bergey's manual (Determinative and Systematic).

Unit IV **16 hrs.**

Importance and Conservation of Microbial Diversity: Importance of microbial diversity in agriculture, forestry, environment, industrial and food biotechnology, animal and human health. Metagenomics. Importance of conservation. *In situ* conservation and *Ex situ* conservation. Role of culture collection centers in conservation.

22MSCT105: Techniques in Microbiology

(Soft Core)

Total number of lecture hours: 64 **Total number of credits: 04**

Unit I **14 hrs**

Principle of Spectroscopy: Beer-Lambert's law and its limitations, chromophore and auxochrome, Principles and instrumentation of colorimeter, spectrophotometer and fluorimeter. Fluorescent probes and their applications.

18 hrs

Unit II

Chromatography: Partition coefficient, RF value, Principle and applications of paper chromatography, thin-layer chromatography, gel filtration chromatography, ion exchange chromatography and affinity chromatography.

HPLC: Instrumentation, RP-HPLC and NP-HPLC, factors affecting resolution in HPLC.

Spectroscopy: Theory and construction of mass spectrometer. Electrospray ionization, ToF, MALDI, LC-MS.

16 hrs

Unit III

Microbial techniques: Isolation of pure cultures- dilution, spread plate, streak plate, pour plate and micromanipulator method. Maintenance and preservation of pure cultures, culture collection center - National and International. Direct microscopic count and standard plate count. autoclave, laminar air flow system (Vertical and Horizontal), incubator, Membrane filtration.

Microscopy: Principles and applications of bright field and dark field microscopy, fluorescent microscopy, Phase contrast microscopy.

Electron microscope – Principles and applications of transmission electron microscope and scanning electron microscope.

16 hrs

Unit IV

Electrophoresis: Principle of electrophoresis, polyacrylamide gel electrophoresis - native PAGE and SDS-PAGE. Zymogram. Agarose gel electrophoresis. Protein staining - CBB and silver and DNA staining - EtBr and SYBR G/R.

22MSCT106: Applied Microbiology

(Soft Core)

Total number of lecture hours: 64 **Total number of credits: 04**

Unit I **16 hrs.**

Primary sources and growth of microbes in food and dairy products, spoilage of fruits, vegetables, meat, poultry, fish, sea foods, milk, cheese and canned foods. Microbiology of fermented foods- sausage, vinegar, shoyu, tofu and idli. Microbiology of fermented dairy products- butter milk, sour cream, yoghurt and cheese. Food and milk borne pathogens- Bacillus, Brucella, Clostridium, E. coli, Listeria, Salmonella, Staphylococcus, Microbial foods: Functional foods and probiotics.

Unit II **20 hrs.**

Distribution of microorganisms in soil. Factors influencing the soil microflora. Role of microorganisms in soil fertility. Interactions among microorganisms - mutualisms, comensalism, competition, amensalism, parasitism, predation. Interactions between microbes and plants - rhizosphere, phyllosphere, mycorrhizae. Microbial interactions in animals - Rumen microflora. Microbial contribution to food digestion.

Unit III **16 hrs.**

Role of microorganisms in waste water treatment, Microbes as pollution indicators, Microbial degradation of herbicides, Biofuel production - biogas, biohydrogen, bioethanol, bioether. Bioleaching, Bioreclamation of mines. Biopesticides Biocontrol organisms Biofertilizers for sustainable agriculture, Significance of biofertilizers.

Unit IV **12 hrs.**

History and basic concept of medical microbiology. Infections, sterilization and disinfection. Normal microflora of human body. Clinical, microbiological, immunological and molecular diagnosis of microbial diseases caused by Staphylococci, Bacillus, Clostridium, Escherichia, Salmonella, Shigella, Klebsiella, Vibrio, Pseudomonas, Mycobacteria, Rickettsia.

Practical I

1. Preparation of nutrient media and sterilization techniques, colony characters of bacteria.
2. Bacterial pure culture and subculture techniques.
3. Isolation of bacteria from water, and soil
4. Staining techniques – simple, gram, acid-fast.
5. Endospore staining.
6. Morphological characteristics of bacteria
7. Screening of amylase, protease and lipase producers
8. Quantification of the activity of microbial amylase

Practical II

1. Serological Diagnosis of Infectious diseases - Serologic test Methods
2. ELISA
3. Ouchterlony Immunodiffusion test
4. Immunoelectrophoresis
5. WIDAL Test
6. HBs Ag test
7. HCG test (Agglutination inhibition test)
8. Detection of RA factor

Semester II

22MHCT201: Microbial Genetics

(Hard Core)

Total number of lecture hours: 64 **Total number of credits: 04**

Unit I

16 hrs.

Concepts in Microbial Genetics: History and developments of microbial genetics. Microbes as genetic tools for basic and applied genetic studies. Generalized reproductive cycles of microbes (Bacteria, Viruses, Neurospora, Chlamydomonas, Saccharomyces, Acetabularia).

Unit II

20 hrs.

Viral genetics: Lytic and lysogenic cycles, phage phenotypes, phenotypic mixing, recombination in viruses: Mapping of rII loci.

Bacterial genetics: Bacterial transformation: types of transformation mechanisms found in prokaryotes, bacterial conjugation: properties of the F plasmid, $F^+ \times F^-$ mating, $F' \times F^-$ conjugation, Hfr conjugation. Transduction: generalized and specialized transduction. Transposable elements.

Unit III

16 hrs.

Fungal Genetics: Neurospora- Tetrad analysis and linkage detection - 2-point and 3-point crosses, chromatid and chiasma interference.

Algal Genetics: Chlamydomonas - unordered tetrad analysis. Nucleocytoplasmic interactions and gene expression in Acetabularia. Extranuclear (cytoplasmic) inheritance.

Transposable elements - insertion sequences, transposons, and integrons. Replicative transposition, non-replicative transposition, excision and transposase-mediated rearrangements. Regulation of transposition. Use of transposons.

Unit IV

12 hrs.

Mutation and mutagenesis: Nature, type and effects of mutations. Mutagenesis - physical and chemical mutagens, base and nucleoside analog, alkylating agents, intercalating agents, ionizing radiation. Induction and detection of mutation in microorganisms, Site directed mutagenesis and its applications. Uses of mutants. Reversion and suppression - Reversion assays - Ames test.

22MHCT202: Immunology

(Hard Core)

Total number of lecture hours: 64 **Total number of credits: 04**

Unit I **18 hrs.**

Introduction: Origin, concept and historical development of immunology.
Cells and organs of immune system: Circulatory and lymphatic systems. Hematopoiesis. Cells of immune system. Types, structure and functions of lymphoid organs.
Immunity: Types - Innate immunity (non-specific). Physical, biochemical and genetic factors involved in governing innate immunity. Molecules of inmate immunity - complement, acute phase proteins and interferons.
Biology of immune cells: B cells - Origin, development, maturation and surface molecules. T cells - Origin, development, maturation and surface molecules. Subsets of T cells. Structure and function of T Cell receptors.

Unit II **20 hrs.**
Antigens and antibodies: Antigens - Physical and chemical properties of antigens, epitopes, entigenicity and immunogenicity. Types of antigens. Super antigen and haptens. Microbes as antigen. Antigen recognition and MHC molecules. MHC molecules-types, structure, genetics and functions. Complement system - Components and pathways of component activation.
Antibodies: Physical and chemical structures of antibodies. Types and biological functions of immunoglobulins. Monoclonal and polyclonal antibodies - production and applications.

Unit III **18 hrs.**
Immune response: Antigen processing and presentation. Activation of T and B cells. Differentiation and formation of functional T cells. Differentiation of B cells and formation of plasma and memory cells. Immune response - Primary and secondary. Effector mechanism of HMI and CMI. Cell mediated cytotoxicity, ADCC and inflammation. Cytokines - types, functions and applications
Hypersensitivity: mechanism and types of hypersensitivity.
Autoimmunity and Immunodeficiency syndrome: Autoimmunity and autoimmune disorders. Immunodeficiency syndrome: AIDS and other acquired or secondary immunodeficiency.

Tumor and transplantation immunology: Tumor antigens and immunology to tumor cells. Transplantation immunology - Blood transfusion, Tissue transplantation and HLA typing. Immunotolerance and immunomodulators.

Unit IV **8 hrs.**
Immunotechniques and Immunodiagnosis: Antigen-antibody reactions: Mechanism and principles of antigen-antibody reactions. Types and determination of antigen-antibody reactions - Radioimmune assay, Ouctherlony double diffusion technique, complement fixation test, enzyme linked immunosorbent assay, Western blotting Antigens and antibody reactions *in vitro.* Agglutination, complement fixation, immunoflourescence, immunoprecipitation, and serotyping.

22MHCT203: Molecular Biology

(Hard Core)

Total number of lecture hours: 64 **Total number of credits: 04**

Unit I **16 hrs.**

Definition, concepts: genes, chromosome, genetic code, prokaryotic and eukaryotic genomic organization structure and types of nucleic acids. Central dogma of molecular biology: transcription and translation in prokaryotes and eukaryotes. Genetic recombination: transformation, transduction and conjugation. Organelle DNA – mitochondrial and chloroplast. Bacterial genome.

Unit II **16 hrs.**

Replication enzymes, factors involved in prokaryotic and eukaryotic initiation, elongation and termination of replication. Transcription, DNA proof reading, activators and inhibitors of replication. Enzymes: activators, transcription factors, prokaryotic and eukarytic promoters. Post transcriptional modifications - splicing, adenylation, capping, polyribosomes, polycistronic and monocystronic mRNA. Transcriptional inhibitors, translation and post translation modifications.

Unit III **16 hrs.**

DNA damage repair mechanisms: Photo reactivation, excision, recombinant, SOS and mismatch repair. Gene regulation in prokaryotes and eukaryotes: operon concept, catabolic repression, control by attenuation. Constitutive and induced Gene expression. Protein splicing, inter and intracellular protein translocation.

Unit IV **16 hrs.**

Molecular biology of cancer: Mechanism of transformation of cells. Physical and chemical carcinogens. Role of carcinogens & oncogenes in cancer. Oncogene proteins - Protein kinases, growth factors, ras proteins, tumor repressor genes. Protein kinases and transformation. Viral oncogenes: Structure and detection of integrated viral DNA.

20MSCT204: Genetic Engineering

(Soft Core)

Total number of lecture hours: 64 **Total number of credits: 04**

Unit I **16 hrs.**

Genetic engineering: Definition, concepts and scope of genetic engineering. Historical perspectives and milestones in recombinant DNA technology (rDNA technology). Importance of gene cloning and future perspectives.

Tools in genetic engineering: Enzymes in genetic engineering. Cloning vectors and their properties- Ti plasmid, pBR322, pUC, Lambda, M13 phage vector. Cosmids - phasmids, phagemids, shuttle vectors. Mammalian expression vectors. Isolation and construction of vectors.

Unit II **20 hrs.**

rDNA Technology: Basic principles of gene cloning strategies. Preparation, manipulation and insertion of desired DNA into vector. Introduction of DNA into host cells - transformation, transduction, transfection, microinjection, electroporation, liposome fusion, shotgun cloning. Genomic and c-DNA libraries. Cloning and expression in bacteria and yeasts. Identification and selection of recombinants.

Unit III **16 hrs.**

Molecular markers in genome analysis: RFLP, RAPD, AFLP and ISSR. Blotting techniques- Southern, Northern and Western blotting techniques. PCR - Principles, types and applications. Synthetic genes of microbes.

Microbial genome sequencing projects: DOE microbial genome programme, TIGR microbial database. Analysis of genome sequences, DNA chips: studying gene expression using DNA microarrays. Nest Generation sequence.

Unit IV **12 hrs.**

Application of gene cloning in biotechnology, medicine, agriculture and forensic science. Anti-sense technology. Restriction and regulation for the release of GMOs into environment, ethical, legal, social and environmental issues related to rDNA technology.

22MSCT205: Environmental Microbiology
(Soft Core)

Total number of lecture hours: 64 **Total number of credits: 04**

Unit I **16 hrs.**

Introduction: Origin, concept and development of environmental microbiology.
Microbial Community: Ecosystem, habitat and niche. Concept and dynamics of microbial population and community. Structure and functions of microbial communities. Ecological succession. **Microbial diversity:** Diversity of microorganisms in different environments. Conventional and molecular methods of studying microbial diversity. Microbes in extreme environments. Extremophiles - Psychrophilic, thermophilic, acidophilic, alkalophilic and barophilic.

Unit II **16 hrs.**

Water Pollution: Sources, characteristics of water pollutants, health hazards due to water pollution. Standard water quality criteria, Water quality testing (MPN technique). Eutrophication - causes, consequences and prevention. **Waste water treatment:** Primary - physical processes. Secondary - biological treatment by fixed biofilm systems (trickling filters, RBC, fluidized bed reactors), suspended systems (activated sludge process, oxidation lagoons, anaerobic digesters, septic tank).

Unit III **18 hrs.**

Air pollution and radiation hazards: Sources and characteristics of air pollutants. Health hazards due to air pollution. Greenhouse gases and greenhouse effect. Ozone hole and acid rain. Radiation hazards and safety measures - sources, effect of radiations and safety measures.
Microbiological indicators: Concept and significance. Microbiological indicators of air pollution.

Unit IV **14 hrs.**

Soil pollution: Sources and characteristics of soil pollutants. Effects of soil pollution on human health and crop productivity.
Solid waste management: Handling and treatment of solid wastes. Sludge handling and disposal - sludge processing, screening, dewatering, thickening, conditioning. Stabilization - aerobic and anaerobic digestion (biomethanogenesis). Handling of biohazard and hospital wastes. **Microbial leaching**: Origin and concept. Mechanism and role of microorganisms in recovery of important minerals - iron, copper and gold.

22MSCT206: Biochemistry and Microbial Metabolism

(Soft Core)

Total number of lecture hours: 64 **Total number of credits: 04**

Unit I **16 hrs.**

Basic concepts of Biochemistry: Atoms, elements, molecules, compounds and biomolecules. Atomic bonds - covalent and non-covalent. Hydrogen bonds and Vander Waal forces.

Biological oxidation: Electron transport system, oxidative phosphorylation, inhibitors and mechanism of oxidative phosphorylation.

12 hrs.

Unit II

Carbohydrates: Classification, structure, properties and functions.

Lipids: Classification, structure, properties and functions.

Amino acids: Classification and types of amino acids, structure and properties

Proteins: Types of protein structures, bonding and stabilization and properties and examples.

20 hrs.

Unit III

Metabolism Carbohydrate metabolism: Glycolysis-significance, regulation. Glycogenesis, glycogenolysis, gluconeogenesis-Significance, regulations; TCA cycle-significance, regulations. Glyoxylate cycle. HMP shunt. **Lipid Metabolism:** Fatty acid oxidation (β-oxidation), Biosynthesis and degradation of cholesterol.

Unit IV **16 hrs.**

Metabolism of amino acids: Transamination, deamination, decarboxylation. Urea cycle - regulation. Metabolism of ammonia.

Nucleotide metabolism: Synthesis of IMP, AMP and GMP. Salvage pathway for purines. Degradation of purine nucleotides. Biosynthesis and degradation of pyrimidine nucleotides.

Practical III

1. Preparation of buffer. Media preparation; nutrient broth, nutrient agar, potato dextrose agar, Czapekdox agar, Mac Conkey's agar.
2. Sterilization techniques, hot air oven, autoclave/pressure cooker, filtration unit.
3. Study of pure culture techniques: Serial dilution, pour plate, spread plate, streak plate, point inoculation.
4. Measurement of growth using - Turbidometer/ photocolorimeter/ spectrometer and Haemocytometer (Yeast cells)
5. Separation of amino acids by paper chromatography
6. Estimation of protein by Lowry's method
7. Estimation of sugar by DNS and anthrone methods
8. Colorimetric estimation of Nucleic acid
9. Isolation of plasmid DNA Extraction of DNA and RNA from, Drosophila, coconut endosperm. Criteria of purity - 260/280 UV absorption ratio

Practical IV

1. Isolation and identification sewage micro flora
2. Isolation and identification soil micro flora
3. Isolation and Identification of airborne microbes - indoor and outdoor
4. Microbes as indicators of water pollution - Determination of indices of water quality
5. Determination of BOD of pollution water
6. Determination of COD of polluted water
7. Effect of high salt concentration on microbial growth
8. Degradation of cellulose by Chaetomium globosum
9. Bacterial examination of drinking water by membrane filter technique
10. Study of associated soil microorganisms with plants, Actinorhiza, Mycorrhiza
11. Study of important microbes in the degradation of wastes

Semester 3
22MOET301: Medical Microbiology
(Hard core)

Course Objectives: To understand the role of normal flora and pathogenic microbes. To understand the pathogenesis of various diseases. To understand the various clinical microbiological techniques.

Course Outcome: After the completion of the course students would be able to learn the concept, etiology and epidemiology of infections and mechanisms of infection, to have knowledge on clinical lab techniques and to acquire knowledge on control measures of diseases.

UNIT I **16 hours**

Introduction to Medical Microbiology: History, concept of disease, disorder, syndrome, Communicable diseases- Normal microbial flora of human body, host microbe interactions. Infection and infection process- routes of transmission of microbes in the body. Types of infections, modes of transmission, portal of entry: Urinary tract infection, sexually transmissible infection, Infection of the central nervous system, Infections of circulatory system, Oral cavity and respiratory infection, gastrointestinal infection

UNIT II **16 hours**

Microbial infections: Description and pathology of diseases caused by bacteria; Streptococcus, Pneumococcus, Gonococcus, Enterobacteriaceae, E. coli, Salmonella, Shigella, Pseudomonas, Klebsiella, Proteus, Vibrio cholera. Mycobacteria, Spirochaetes. Mycoplasma pneumoniae, Protozoa diseases-Trichomoniasis, Celebral Malaria, Hemorrhagic fever, Swine flu, SARS, Chikungunya, Ebola.

UNIT-III: **16 hours** Viral diseases: Description, pathology and lab diagnosis of diseases caused by pox viruses; herpes virus (chicken pox- zoster); orthomyxo and paramyxo viruses; adenovirus, other respiratory viruses, (Influenza, Rhyno) viruses affecting nervous system (ex: Polio virus, Rabies virus), enterovirus, viral hepatitis, HIV.

UNIT-IV: Description and pathology of diseases caused by Aspergillus, Penicillium, Mucomycosis, Description and pathology of diseases - Leishmania tropica Giardia, malarial parasites, Helminthes; Filarial parasites. Methods of transmission and role of vectors- biology of vectors. House fly, Mosquitoes and sand fly.

UNIT IV **16 hours**

Laboratory diagnosis and Prevention: Diseases caused by Viruses: Chicken pox, encephalitis, Herpes simplex, Influenza, Dengue Diseases caused by Bacteria: Tuberculosis, Leprosy, cholera, Typhoid, Salmonellosis, Tetanus. Diseases caused by Fungi: Candidiasis, Aspergillosis.

References:

1. Robert W. Bauman Ph.D. (2011) Microbiology with Diseases by Body System (3rd Edition); Benjamin Cummings

2. Patrick R. Murray PhD, Ken S. Rosenthal PhD, Michael A. Pfaller MD (2012) Medical Microbiology; Saunders

22MSCT302: Food and Dairy Microbiology

Course Objective:

The course aims to provide instruction in the general principles of food microbiology. • The course covers the biology and epidemiology of food borne microorganisms of public health significance, including bacteria, yeasts, fungi, protozoa and viruses.

Course Outcome:

1. To understand the principles of microorganisms during various food-processing and preservation steps.
2. To comprehend the interactions between microorganisms and the food environment, and factors influencing their growth and survival. • To understand the significance and activities of microorganisms in food.
3. To recognize the characteristics of food-borne and spoilage microorganisms, and methods for their isolation, detection and identification.

UNIT I **16 hours**

Introduction to food microbiology: Definition, concepts and scope. Food as substrate for microbes. Factors influencing microbial growth in food- extrinsic and intrinsic factors. Principles of food preservation- Chemical preservatives and food additives Asepsis-Removal of microorganisms, (anaerobic conditions, high temperatures, low temperatures, drying). Canning, processing for Heat treatment.

UNIT II **16 hours**

Dairy Microbiology: Microbiology of raw milk, Milk as a vehicle of pathogens, Prevention of contamination of raw milk, Microbiology of processed milk, Spoilage and defects fermented milk and milk products, Microbiological standards for milk and milk products. Cream and butter bacteriology. Prebiotics and Probiotics. Contamination and food spoilage: Cereals, sugar products, vegetables, fruits, meat and meat products, Fish and sea foods- poultry- spoilage of canned foods.

UNIT III **16 hours**

Food poisoning and intoxication: Significance of food borne diseases, Food poisoning and intoxication: Botulism, Listeriosis, Bacillus cereus food poisoning, Food borne Gastroenteritis by Salmonella, Shigella, Vibrio, Campylobacter and Yersinia, Staphylococcus and Staphylococcal enterotoxins, fungal spoilage and Mycotoxins.

UNIT IV **16 hours**

Detection of food-borne microorganisms: Culture, Microscopic and Sampling methods. Chemical: Thermostable nuclease Limulus Lysate for Endotoxins, Nucleic Acid (DNA) probes, DNA Amplification (PCR), Adenosine- Triphosphate Measurement, Radiometry, Fluoro-and Chromogenic substrates. Immunologic Methods: Fluorescent Antibody, Enrichment Serology, Salmonella 1-2. Test, Good manufacturing process (GMP) Microbiological standards Codex Alimentarius and Food legislation with respect to FSSAI, and NABL.

22MSCT303: Industrial Microbiology

Course objective: To give knowledge on strain improvement methods, to learn different fermentation techniques, bioreactor design, inoculum development.

Course Outcome:

1. To get knowledge on strain improvement, methods of manipulating the metabolic pathways to get the desired yield.
2. To understand industrial production and purification of antibiotics, amino acids and steroids.
3. To understand the application of these bio-molecules in benefit to mankind

UNIT I **16 hours**

Introduction: Fermenter design and types of fermenters, achievement and maintenance of aseptic conditions, Types of fermentation processes (Surface, submerged, Batch, Continuous, solid-substrate, Dual, Fed batch fermentation and its applications), Industrial Microorganisms: Screening, Isolation. Identification and characterization of industrially important microbes. Strain improvement- mutation, recombination. Preservation of industrially important microbes. Culture collection centers.

UNIT II **16 hours**

Media for Industrial Fermentations: Media formulation, growth factors, carbon, nitrogen, Energy and Mineral sources, buffers, inhibitors, precursors, inducers, Oxygen requirements Antifoam agents and others, Sterilization: Sterilization of bioreactor, media, air and exhaust air and filter sterilization Downstream processing of fermentation: Steps in recovery and purification Methods of cell separation – filtration and centrifugation, cell disruption and recovery. Fermentation economics- expenses for industrial organisms, media sterilization, heating, cooling, aeration and agitation.

UNIT III **16 hours**

Industrial production of energy fuels: Industrial alcohol production: Biosynthesis, methods of production, recovery and applications of ethanol, acetone – butanol and glycerol through microbial process. Industrial production of Organic acids and Enzymes: biosynthesis, media, production process, product recovery and application of citric acid and lactic acid.

UNIT IV **16 hours**

Industrial production of food additives: amino acid production, methods of production, product recovery of L-Glutamic acid and L-lysine. Commercial uses of Amino acids Vitamins: Commercial production of Vitamin B12. Alcoholic beverages (Beer, Wine,). Industrial production of health care product: Production of β-lactum antibiotic (Penicillin): Biosynthesis, production and recovery.

References:

1. Barsanti, L and Gualtieri, P. 2005. Algae: Anatomy, Biochemistry, and Biotechnology. Taylor and Francis NewYork.
2. Casida, L.E. 1997. Industrial Microbiology. New Age InternationalPublishers.
3. Crueger, W. and Crueger, A. 2003. Biotechnology- A text book of Industrial Microbiology. PanimaPublishingcorporation.
4. Demain, A. L. 2001. Industrial Microbiology and Biotechnology IInd Edition. ASM Press, Washington.
5. Demain, A.L. and Davies, J.E. 1999. Manual of Industrial Microbiology and Biotechnology IInd Edition. ASM Press,Washington.

22MSCT304: Agricultural Microbiology

Course objectives:

1. To study the microbes associated with the plant and soil fertility.
2. To understand about beneficial microbes and their uses in protecting agriculture, preserving food, enhancing the value of food products and providing general benefits to health and wellbeing.

Course Outcome:

1. After the completion of the course students would be able
2. To develop newer approaches for plant disease management.
3. To know the application of microbial biocontrol agents and to reduce drug resistance and environmental pollution.

UNIT I **16 hours**

Introduction to Agricultural Microbiology: Introduction to agricultural microbiology, concepts and scope of agricultural microbiology, Agronomy and production of important crop plants, Green revolution. Plant Pathology: Concept of disease, History of Plant Pathology, Significance of plant diseases, Symptoms and types of plant diseases. Diagnosis of Plant Diseases – Infectious diseases, Non-infectious diseases, Kochs'rules;

UNIT II **16 hours**

Parasitism and Disease Development, Host range of pathogens, Disease triangle, Diseases cycle / Infection cycle, Relationship between disease cycles and epidemics; Pathogens Attack Plants – Microbial toxins and enzymes. Environment and Plant Disease– Effect of Temperature, Moisture, Wind, Light, Soil, pH and structure, Nutrition and Herbicides.

UNIT III **16 hours** Plant Disease & their management: Tobacco Mosaic Disease, Bacterial blight of Paddy, Citrus canker, Angular leaf spot of cotton, Late Blight of Potato, Downy Mildew of Bajra, Blast of paddy, Tikka disease of ground nut, Rust of coffee, Grain and Head smut of Sorghum. Powdery mildew of Cucurbits, Wilt of Tomato, and Root Knot of Mulberry.

UNIT IV **16 hours**

Microbes and Plant interactions - Mycorrhizae-Biology and their applications, Biofertilizers - microbial inoculants. Production and application of Rhizobium, Azospirillum, Azotobacter, phosphor bacteria and Cyanobacteria. PGPR's plant growth promoting Rhizobacteria and their uses. Biopesticides: Bacteria-endo and ecto-toxins production by Bacillus thuringiensis, and Pseudomonas. Fungi- Cephalosporium, and Trichoderma.

References:

1. George. N. Agrios (2005),Plant pathology, Elsevier academic press, 5th edition,U.K.
2. Mehrotra. R.S. and Ashok Aggarwal (2002), Plant pathology, Tata MC Graw-Hill publishers, 2nd edition,Delhi.
3. Kannaiyan. S. (2002), Biotechnology of Biofertilizers, Alpha science international, 1st edition.

22MSCT305: Clinical & Diagnostic Microbiology

Course Outcomes:

1. After the completion of the course students would be able
2. To develop skill to isolate and identify microorganism form clinical sample.
3. To do antibiotics sensitivity and resistance test
4. To do detection of parasite/ pathogens using diagnostic kits.

Course Pedagogy:

1. Knowledge about microbes causing disease.
2. Knowledge about various laboratory techniques like microscopy, immunological assessments, radiology, biomarker tests, ELISA, serology checks, vaccines and vaccines schedule.

UNIT I **16 hours**

Introduction to clinical Microbiology: Role of Microbiologist in Diagnostic laboratory, General concepts for specimen collection, handling, transportation, processing, specimen workup, Laboratory safety and infection control. Scientific and Laboratory basis for Clinical/Diagnostic Microbiology: Microscopic examination of infectious diseases, Growth and biochemical characteristics, Rapid methods of identification.

UNIT II **16 hours**

Immunotechniques and Immunodiagnosis: Antigens and Antibody reactions in vitro; Agglutination, complement fixation, ELISA, Western Blotting Immunodiffusion, Immunoelectrophoresis, Immunoflurescence, Immuno precipitation, Radioimmunoassay and serotyping. Vaccines and Vaccination: Vaccines – definition, types, Antigens used as Vaccines, effectiveness of vaccines, Vaccine safety, current vaccines, adjuvants, active immunization and passive immunization.

UNIT III **16 hours**

Recent Diagnostic tools and techniques: Principle, working and application of a) Autoanalyser b) Biosensor glucometer /labon chip/microfluidics c) Diagnositic kits- ELISA, Western Blot d) Enzymes in Disease diagnosis and therapy: Lactate dehydrogenase, Aspartate aminotransferase, Alkaline phosphatase, Creatine kinase, Acid phosphotase, Cholinesterase.

UNIT IV **16 hours** Antimicrobial

Chemotherapy: Development of chemotherapy; General characteristics of drugs and their testing; Mechanism of action. Antibacterial drugs; antifungal drugs, antiviral and antiprotozoan drugs; antibiotic sensitivity testing, MIC, Drug resistance; mechanism of multi drug resistance.

Reference

1. Alberto M. Marchevsky and Mark Wick. (2011). Evidence Based Pathology and Laboratory Medicine. Springerpublication.
2. David E. Bruns; Edward R. Ashwood; Carl A. Burtis; Barbara G. Sawyer (2007). Fundamentals of Molecular Diagnostics St. Louis, Mo. : Saunders Elsevier 1. GouraKudesia (2009) Clinical and Diagnostic Virology. Cambridge University Press.UK.
3. HenrikWinther and Jan T. Jorgensen (2010). Molecular Diagnostics. Springer publications.

22MSCT306: Soil Microbiology

Course Pedagogy:

1. Lectures are held with the help of slides, the laboratory lessons will be performed in a laboratory designed and equipped for microbiological practices.

Course Outcome:

After the completion of the course students would be able to have knowledge about soil as an excellent habitat for multitude of microorganisms balancing the soil ecosystem. To be employable in the field of Agronomy/Soil Science. To acquire skills and knowledge on the importance of microorganisms in biogeochemical cycles biological fertility of soil.

UNIT I **16 hours**

Soil Microbiology: Historical accounts and the "Golden Age" of soil microbiology and significant contributions of pioneer soil microbiologists. Soil Microbial diversity: Soil as habitat for microbes; soil pH, temperature and soil atmosphere. Diversity and abundance of dominant soil microorganisms, Methods of isolation of soil microflora, soil organic matter decomposition,

UNIT II **16 hours**

Biogeochemical cycles: Organic matter decomposition, humification. Carbon, sulphur, nitrogen and iron cycles in soil. Soil microbe interaction - Antagonism, commensalism, mutualism, symbiosis, predators and parasite relationship and competition. Interaction of soil microflora with vascular plants - Rhizosphere, rhizoplane microorganisms, Rhizobium.

UNIT III **16 hours**

Techniques to study soil organisms: Microbial biomass estimation; fumigation-incubation technique, fumigation-extraction method, substrate-induced respiration method and Using ATP or enzyme activity Applied soil microbiology: soil microbial inoculants, Manipulations of soil microorganisms for agriculture, Soil environmental contaminants and Bioremediation,

UNIT IV **16 hours**

Soil-Borne Diseases and Human Health: Clostridium tetani (tetanus), Toxoplasmosis, Aspergillosis, Actinomycosis. Soil microorganisms in agro ecosystems: Types of microbial communities; soil microbial diversity: significance and conservation; effect of agricultural practices on soil organisms. Biological nitrogenfixation: The range of nitrogen fixing organisms; mechanism of nitrogen fixation (biochemistry of nitrogenase); genetics of nitrogen-fixation; Rhizobium-Legume Association; N2 fixation by non-leguminous plants.

References:

1. Agrios, G. N. 2000. Plant pathology. Harcourt Asia Pvt.Ltd.
2. Bergersen, F.J. and Postgate, J.R. 1987. A Century of Nitrogen Fixation Research Present Status and Future Prospects. The Royal Soc. London.
3. Buchanan, B.B., Gruissem, W. and Jones, R.L. 2000. Biochemistry and Molecular Biology of Plants.

Practical V

1. Replica plating technique for transfer of bacterial colonies.
2. Demonstration of Bacterial transformation.
3. Demonstration of Plate mating.
4. Genetic recombination (Conjugation) in Bacteria.
5. Isolation of streptomycin resistant strain of E. coli by gradient plate method.
6. Isolation of DNA from bacteria by heat lysis method
7. Isolation of DNA from yeast by DNA spooning technique
8. Ordered and random ascospore analysis in Neurospora crassa
9. Ultra-violet killing curve and determination of mutant types in Saccharomyces cerevisiae.
10. Induction of mutation

Practical VI

1. Immunological Methods used for organism detection - production of antibodies for use in laboratory testing
2. Serological Diagnosis of Infectious diseases - Serologic test Methods
3. Precipitin test
4. ELISA
5. Ouchterlony Immunodiffusion test
6. Immunoelectrophoresis
7. Complement fixation test
8. Isolation of Antigens and raising antibodies from animals (from different Models)
9. Development of polyclonal antibodies, purification of antibodies
10. HBs Ag test
11. HCG test (Agglutination inhibition test)
12. Detection of RA factor
13. CRP test

22MOET401: General Microbiology

(Open Elective)

Total number of lecture hours: 64 **Total number of credits: 04**

Unit I **18 hrs.**

Historical overview of microbiology. Contributions of scientists - Antony van Leeuwenhoek, Louis Pasteur, Robert Koch, Paul Ehrlich and Alexander Fleming. Important events in development of microbiology. Scope and relevance of microbiology. Classifying and naming microorganisms: Classification systems, ICNB rules, major characteristics used to classify microorganisms.

Unit II **18 hrs.**

Culture media for microbes types of media - general purpose media, special purpose media- selective, elective, diagnostic and resuscitation media. Media for fungi, algae, bacteria, mycoplasma and viruses. Pure culture techniques: different types of inoculation techniques - spread plate, pour plate and streak plate methods.

Unit III **18 hrs.**

Control of microorganisms: Chemical methods: Definition of terms- disinfectants, dntiseptics, sanitizers, microbicides, microbistatic. Use and mode of action of alcohols, aldehydes, halogens, phenols, heavy metals, and detergents. Sterilization techniques: Principles, types of sterilization, and their mode of action. Physical methods: Heat - dry heat, incineration, moist heat, tyndalization (fractional sterilization). Filtration-types of filters. Laminar airflow. Radiation methods.

Unit IV **10 hrs.**

Importance of microorganism: agriculture, industry, medicine, environment.

22MOET402: Molecular Biotechnology

(Open Elective)

Unit-I: **16 hrs**

r-DNA technology- Isolation of nucleic acids, DNA sequencing, maxam-Gilbert and Dideoxy methods. Restriction endonucleases, restriction maps, Southern, Northern blotting and western blotting. DNA finger printing, PCR- principle, types, application.

Unit-II: **16 hrs**

Cloning vectors- Plasmids, Cosmids and bacteriophages. Ligases- DNA ligases, ligation of fragments with cohesive ends & blunt ends; homopolymer tailing, Cloning strategies – shot gun experiments, gene libraries. Isolation of poly mRNA, synthesis of c-DNA, cloning of c-DNA in bacteria. Isolation of cloned genes, identification of recombinants, structural and functional analysis of recombinants.

Unit-III **16 hrs**

Gene expression- expression of cloned genes in bacteria, yeast, plant and animal cells. Application of recombinant DNA technology in biology, plant, medicine, genetic diseases, gene therapy. Genetically engineered microorganisms and intellectual property rights.

Unit-IV **16 hrs**

Nucleic acid probe technology, DNA micro array – printing of oligonucleotides and PCR products on glass slides, nitrocellulose paper. Whole genome analysis for global patterns of gene expression using fluorescent-labelled c-DNA or end labeled RNA probes. Analysis of single 23 nucleotide polymorphisms using DNA chips. Protein micro array, advantages and disadvantages of DNA and protein micro arrays.

References:

1. Molecular Biotechnology by Glick & Palturah, 2003, 3rd Edition.

2. Modern Biotechnology by Primrose.

3. Molecular Cell Biology by Lodish et al.

4. Advanced Molecular Biology: A concise reference by R.Twyman.

5. Principles of Gene Manipulation: An introduction to genetic engineering by Old & Primrose.

Project work

22MICROPR403: Research Work

PROJECT WORK

The candidate should submit a project report by the end of final year course on a topic relevant Microbiology, based on the laboratory experiments/case studies/field studies carried out in a microbiology/related industry and should give a seminar on the project work.

Adichunchanagiri University

Adichunchanagiri School of Natural Sciences

Question Paper Pattern for Internal Assessment

Time: 1.30 Hours **Max Marks: 30**

I. Answer **any Five** of the following 2× 5 = 10

1.

2.

3.

4.

5.

6

7

II. Write notes on **any two** of the following 2 × 10 = 20

6.

7.

8.

Notes

Three tests to be conducted for 30 marks each and the average of the best two will be considered. In Addition, Marks allotted for Assignments shall be 5 and for Seminars shall be 5 in respective courses – Finally accounted to 40 (30+5+5) Marks as Internal Assessment.

Adichunchanagiri University
Adichunchanagiri School of Natural Sciences
Question Paper Pattern for University Examination

Time: 3 Hours **Max Marks: 60**

I. Answer **any Five** of the following 2 × 5 = 10

1.
2.
3.
4.
5.
6.
7.

II. Answer **any Four** of the following 5 × 4 = 20

8.
9.
10.
11.
12.

III. Answer **any Three** of the following 10× 3 = 30

13.
14.
15.

16.

Note: While setting question paper equal weightage will be given to all the units of the paper.