

## Mangalore University

Course pattern, Scheme of Examination and Syllabus for M.Sc. Microbiology

### Choice based credit system (CBCS)

Semester	Course	Title of the Paper	Instruction hrs/week	Duration of exam	Marks			Credit
					IA	EXAM	TOTAL	
First Semester	MB 401	General Microbiology	4	3	30	70	100	4
	MB 402	Mycology & Phycology	4	3	30	70	100	4
	MB 403	Microbial Diversity & Microbial Genetics	4	3	30	70	100	4
	MB 404	Biochemistry & Biophysics	4	3	30	70	100	4
	MB 405	Practical – I	4	4	15	35	50	2
	MB 406	Practical – II	4	4	15	35	50	2
	MB 407	Practical – III	4	4	15	35	50	2
	MB 408	Practical – IV	4	4	15	35	50	2
	MB 409	Seminar / Assignment	1	-	25	-	25	1
		<b>Total</b>					<b>625</b>	<b>25</b>
	MB	Microbial Physiology	4	3	30	70	100	4

	451							
	MB		4	3	30	70	100	4
	MB 452	Plant Pathology	4	3	30	70	100	4
	MB 453	Biostatistics & Bioinformatics	4	3	30	70	100	4
	MB 454	Biochemical Techniques	4	3	30	70	100	4
	MB 455	Practical – V	4	4	15	35	50	2
	MB 456	Practical – VI	4	4	15	35	50	2
	MB 457	Practical –VII	4	4	15	35	50	2
	MB 458	Practical – VIII	4	4	15	35	50	2
	MB 459	Seminar / Assignment	1	-	25	-	25	1
		<b>Total</b>					<b>625</b>	<b>25</b>

		<b>Shall opt the Students any faculty</b>						
MB 502	Molecular Microbiology	4	3	30	70	100	4	
MB 503	Industrial Microbiology	4	3	30	70	100	4	
MB 504	Immunology & Medical Microbiology	4	3	30	70	100	4	
MB 505	Practical – IX	4	4	15	35	50	2	
MB 506	Practical – X	4	4	15	35	50	2	
MB 507	Practical – XI	4	4	15	35	50	2	
MB 508	Practical – XII	4	4	15	35	50	2	
MB 509	Mini Project Work	1	-	25	-	25	1	
	Sumer Project after II Sem shall be Considered							
	<b>Total</b>					<b>625</b>	<b>25</b>	

Fourth Semester	MB 551	Agriculture Microbiology	4	3	30	70	100	4	
	MB 552	Environmental Microbiology	4	3	30	70	100	4	
	MB 553	Food & Dairy Microbiology	4	3	30	70	100	4	
	MB 554	Microbial Biotechnology	4	3	30	70	100	4	
	MB 555	Practical – XIII	4	4	15	35	50	2	
	MB 556	Practical – XIV	4	4	15	35	50	2	
	MB 557	Practical – XV	4	4	15	35	50	2	
	MB 558	Project Work	4	4	15	35	50	2	
	MB 559	Seminar	1	-	25	-	25	1	
			<b>Presentation of the Project Work shall be Considered</b> (Literature review, pre final work done)						
		<b>Total</b>					<b>625</b>	<b>25</b>	



**Paper: MB 402**

**Mycology and Phycology**

**56 hrs**

**UNIT-I**

**14 hrs**

Fungi – General characters, Distribution and Classification, Ultra Structure of fungal cell and cell wall, Nutrition in Fungi. Reproduction in Fungi: Vegetative, Asexual and Sexual. Types of fruiting bodies and fungal spores, Differences between fungi and algae.

**UNIT- II**

**14 hr**

Fungal Systematic: Oomycetes, Zygomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes, Endophytic and foliicolous Fungi. Mycorrhiza – Ecto, Endo and Vesicular Arbuscular Mycorrhiza. Applied mycology – Use of fungi in Biocontrol and as food lichens

**UNIT – III**

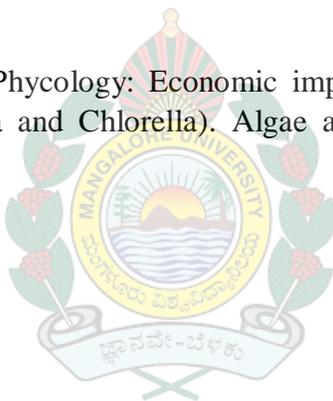
**14 hrs**

Algae: General character, Classification of algae. Blue green algae: Distribution and Classification, Morphology and Ultrastructure Structure of Cyanophycean cell.

**UNIT – IV**

**14 hrs**

Reproduction in Algae, Applied Phycology: Economic importance of Algae, Cultivation and uses of Algae as SCP (Spirullina and Chlorella). Algae as indicator of pollution, Algae as Biofertilizer.



**Paper: MB - 403 Microbial Diversity and Microbial Genetics**

**56hrs**

**UNIT – I**

**14 hrs**

Classification of Microbes based on their nutrition and food chain. Microbial interaction: Symbiosis, Mutualism, Commensalisms, Competition, Synergism, Parasitism and Predation. Rhizospore and Phyllospheremicroflora. Microbial life in extreme and their adaptations – effect of temperature, pH, pressure, salt, heavy metals and radiations. Bioleaching and Indicator organisms

**UNIT – II**

**14 hrs**

Biodeterioration – Role of wood rotting and litter degrading microorganisms. Intestinal micro flora Biofilms Rumen Microbiology. Maintenance of genetic material and genetic library. Conventional and molecular methods of studying microbial diversity.

**UNIT – III**

**14 hrs**

Cell cycle: Cell division and cell differentiation. Contribution of Griffith, Avery, Hershey and Chase towards Genetics. Genetic recombination – Conjugation, transformation, introduction and transfection. Genetic analysis in microbes: Plasmids, Bacteriophages. Heterosexualism in fungi

**UNIT – IV**

**14 hrs**

Genetic mapping: Complementation analysis, detection mapping, cis-trans test. Exons and Introns. Overlapping genes. Transposons. Mutation and Mutagenesis: Gene mutation, types and isolation of mutants. Advanced microbial genetics. General mechanism of genetic engineering in eukaryotes and prokaryotes. Restriction Mapping, Gene Amplification. Transfection of a cloned gene into a eukaryotic cell and its expression

**Paper: MB-404**

**Biochemistry and Biophysics**

**56 hrs**

**UNIT – I**

**16 hrs**

Macromolecules in biological systems Carbohydrates: Classification, Properties and function, Identification and analysis of Mono, Oligo and Polysaccharides. Proteins: Classification, Properties and metabolism of Amino acids, Primary, Secondary, Tertiary and degradation of proteins, Protein – Protein and Protein – DNA interactions.

**UNIT – II**

**16 hrs**

Lipids: Classification, Properties and Function, Biosynthesis, Transports and Degradation. Nucleic acids: Classification and Properties of Nucleic acids, Intra and inter molecular interaction of Nucleic acids: Biosynthesis of purines and pyrimidines, degradation of nucleic acids.

**UNIT – III**

**10 hrs**

Biomembranes – Composition and fine structure of cell membrane, Membrane Lipids, Lipid Bilayer, Membrane Proteins ( Location and their function), Sugar Moieties and Membrane, Glycoprotein and Glycolipids, Molecular Models of cell membrane and liposomes, membrane fluidity and membrane fusion, membrane signalling. Reconstitution of functional membrane system from purified components. Membrane of RBC, Glycoprotein, Transmembrane helices.

**UNIT – IV**

**14 hrs**

Cell permeability and Transport: Transport across cell membrane- permeation at the expose of energy, metabolically coupled active transport, Bulk Transportation, Endocytosis, Phagocytosis, Phagotrophy, Eutrophy, Pinocytosis, Exocytosis and other membrane bound enzymes. AdenylCyclase, Permease transport proteins. Cell signalling: Signalling molecules and Messengers, Signalling Pathways.

### **MB 405: Practical – I04hrs**

1. Study of Instruments
2. Preparation of Culture media
3. Study of inoculation method in Microbiology
4. Study of colony characters of Bacteria
5. Staining techniques: Simple, Differential, Negative, Endospore & Flagellar
6. Hanging drop technique
7. Micrometry
  8. Use of Haemocytometer
9. Study of Bacterial growth curve
10. Enumeration of bacteria from various sources

### **MB 406: Practical – II**

1. Isolation of fungi from soil and air
2. Slide culture & moist chamber technique for cultivation of fungi
3. Identification of fungi based on colony characters and spore observation
4. Study of Arbuscularmycorrhizae & Identification
5. Enumeration of Arbuscularmycorrhizae from soil and plant roots
6. Measurement of Fungal growth by biomass and radial growth
7. Isolation & culturing of Cyanophycean members
8. Isolation & Identification of Endophytic fungi
9. Isolation & Identification of follicolous fungi
10. Cover slip technique for preparing permanent Fungus mounts

### **MB 407: Practical – III**

1. Isolation and Identification of Bacteria, Fungi, Protozoa & Algae
2. Isolation of microorganisms from Rhizosphere & Phyllosphere
3. Effect of metals on microbial growth
4. Isolation and Identification of common wood rotting fungi
5. Single colony isolation
6. Isolation of Bacteriophage from Sewage water & Titration of Bacteriophage stock
7. Isolation of Antibiotic Resistant mutants by Gradient plate method
8. Replica Plating Method
9. One step growth curve of Bacteriophage
10. Solving Genetic Problems

### **MB 408: Practical – IV**

1. Estimation of reducing sugar by DNS method
  2. Estimation of Starch by Iodine method
  3. Estimation of Protein by Lowry's method

4. Estimation of Protein by Biuret method
5. Estimation of Saponification value of fats
6. Estimation of Peroxide Value
7. Gelatin Hydrolysis by microorganisms
8. Fermentation of Carbohydrates
9. Casein Hydrolysis
10. Determination of specific gravity of fats & oils

## **MB 409: SEMINAR/ ASSIGNMENT**



## SECOND SEMESTER

**PAPER: MB 451**

**MICROBIAL PHYSIOLOGY**

**56HRS**

### **UNIT-1:**

**14hrs**

Bioenergetics: Entropy, Entalpy, Electron Carriers, Electron Donors, Inhibitors, Uncouplers, Energy bonds, Phosphorylation, Basic concepts of Acids, Base  $p^H$  and buffers.

### **UNIT-2:**

**14hrs**

Photosynthesis: Eukaryotic and Prokaryotic Photosynthesis, Chlorophyll and Bacterial Chlorophyll, Oxygenic and Anoxygenic Photosynthesis, Autotrophic Generation of ATP, Calvin Cycle, C<sub>3</sub> and C<sub>4</sub> pathways

### **UNIT-3:**

**14hrs**

Chemolithotrophy, Sulphur, Iron, Hydrogen, Nitrogen, Oxidation, Methogenesis and respiratory Metabolism: Aerobic and Anaerobic respiration, Embden-Meyerhof pathway, Parnas pathway, Krebs Cycle Oxidative and substrate level Phosphorylation, Gluconeogenesis, Carbohydrate metabolism, Protein metabolism, Lipid metabolism, Pasteur Effect, Fermentation of carbohydrates, Homo and heterolactic fermentation, Production of secondary metabolites, Bioluminescence and Anaerobic respiration. Assimilation of nitrogen-Nitrogen fixation, Nitrate and Ammonia

### **UNIT-4:**

**14hrs**

Vitamins-Role of vitamins and coenzymes in metabolism. Enzymology: Classification, Specificity, Active sites, Activity units, Isoenzymes, Enzyme kinetics, Michaelis-Menton Equation, determination of Kinetic parameters, Multistep reaction, Rate limiting steps, Enzyme inhibitors, allosterism, kinetic analysis of allosteric enzymes, Principles, Allosteric Regulators

**PAPER: MB 452**

**PLANT PATHOLOGY**

**56hrs**

### **UNIT-1:**

**14hrs**

History and scope of plant pathology: Nature and concepts of plant diseases, Pathogenesis, levels of parasitism. Disease symptoms and its importance, Classification of plant disease. Classification of plant pathogenic organisms, General features, Structure and Reproduction, Disease triangle and plant disease cycle, Phytopathological methods in pathology

**UNIT-2:****14hrs**

Host parasite interaction: Mechanism of penetration and infection-pre penetration, penetration and infection: Biotrophic and Necrotrophic pathogen, Physiology of Host Parasite Interaction: Effect of infection physiological function of Hosts, Translocation of Water and Mineral Nutrients, Organic Nutrients, Respiration and permeability

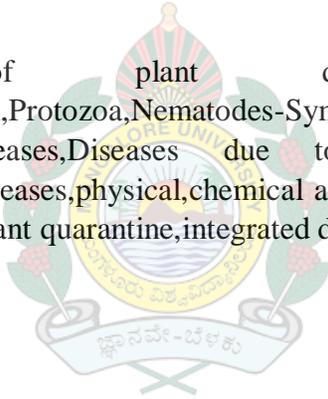
**UNIT-3:****14hrs**

Genetics of Host-Parasite interaction, Genes and Variability in pathogen, Genetics of virulence and resistance, Gene to gene concept, Horizontal and vertical resistance.

Epidemiology: Development of epidemics, measurements, Disease forecasting, factors affecting epidemics, classification, Pattern and Development borne disease and its importance

**UNIT-4:****14hrs**

General aspects of plant diseases caused by viruses, mycoplasmas, Bacteria, Fungi, Protozoa, Nematodes - Symptoms, Etiology, Transmission and life cycle, non parasitic diseases, Diseases due to angiosperm parasites with examples. Management of plant diseases, physical, chemical and Biological. Breeding for disease resistance, Cultural practices and plant quarantine, integrated disease management concept



**PAPER:MB 453 BIO-STATICS AND BIO-INFORMATICS 56hrs**

**UNIT-1: 14hrs**

Measure of central Tendencies:Mean,.median and mode.Measure of Dispersion:Range,SD,CV and SE.Scatter plot,simple correlation and regression,multiple correlations.Construction of frequency table.Statistical inference:Normal,T,Chi-square and F Test,Analysis of Variance.Statistical basis of Biological Assays,Response dose,Meta meter,dilution assay,direct and indirect assay,Quantal response,LD50,ED50,PD50,Standard line interpolation assay,parallel line assay(4 point and 6 point assay),slope ratio assay.Standard statistical packages,Statistical methods,introduction,importance and application of statistics

**UNIT-2: 14hrs**

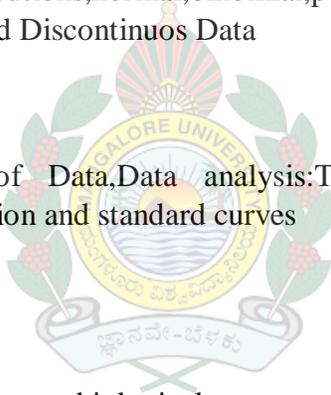
Definition of Statistics:Sample,population and universe,statistical inference,parameter and Statistics,statistics Designing,Random Number and Randomization,RBD,CRBD.Distributions,normal,binomial,poison,Confidence limits of counts,Types of Data,Continuous and Discontinuous Data

**UNIT-3: 14hrs**

Tabulation and representation of Data>Data analysis:Test of significance,t,chi-square,F test,Goodness of fit,Linear Regression and standard curves

**UNIT – IV 56hrs**

Introduction to Bio-Informatics, History, biological sequences, pattern recognition and prediction, sequence analysis, Homology and analogy, Proteomics – general principles, primary sequences Database, Composite protein sequence database, structure, classification database. Genomics: DNA and RNA analysis, Expression profiles. Drug designing, DNA chip, Protein chips and micro array technology. Brief account on search engines and biology workbench



**PAPER: MB 454 BIOCHEMICAL TECHNIQUES 56hrs**

**UNIT – I 14hrs**

Bioprocesses – introduction, Bio products their characters, need for bioprocesses. Cell disruption, filtration, adsorption, extraction methods. Centrifugation: principles, concepts of RCF, types of centrifuges & rotors. Ultra centrifugation. Determination of molecular weights & other applications

**UNIT – II 14hrs**

Membrane separation processes: membrane filtration, principles, preparation & types. Dialysis, ultrafiltration, microfiltration, reverse osmosis, electro dialysis & their applications. Precipitation of molecules: aqueous, organic solvents, salt precipitation buffers.

**UNIT – III 14hrs**

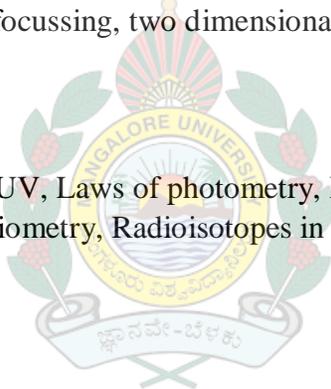
Chromatography: types, principles & applications. Paper, TLC, Ion exchange, gel permeation, GC, GS-MS, HPLC, FPLC, and electrophoresis: principles, types, paper, cellulose acetate/nitrate, Gel & capillary. Isoelectric focussing, two dimensional electrophoresis, gel documentation

**UNIT – IV 14hrs**

Spectroscopy, principles visible & UV, Laws of photometry, Beer-Lambert's law: application of colorimetry, fluorimetry, NMR. Radiometry, Radioisotopes in biomedical research, autoradiography & RIA

**MB 455: Practical – V**

1. Indole production test
2. Catalase test
3. MR – VP test
4. Citrate utilization test
5. H<sub>2</sub>S test
6. Urease production test
7. Deamination test
8. KOH solubility test
9. Triple Sugar Iron test
10. Measurement of bacterial growth by turbidity & plating methods



### **MB 456: Practical – VI**

1. Study of foliar infection
2. Seed health testing by Ferric chloride & Segregation methods
3. Test for germination percentage & Vigor index
4. Isolation & identification of seed borne fungi
5. Isolation & identification of microbes from spoiled vegetables
6. Isolation & identification of Nematodes
7. Study of Coffee leaf rust
8. Effect of plant extracts on fungal spore germination
9. Effect of Fungicides on fungal spore germination
10. Demonstration of Koch's Postulates for a Bacterial & Fungal pathogen

### **MB 457: Practical – VII**

1. Measurement of Central tendencies, mean, median, mode
2. Measures of dispersion range, SD, CV & SE
3. Scatter plot, Simple Correlation & Regression, Multiple Correlations
4. Construction of frequency table
5. Theoretical distribution, Binomial poison & normal
6. Statistical inference, normal, t test, chi-square & F test
7. Analysis of Variance
8. RBD & CRBD
9. Overview of Search engines like ISIS plot, Swiss – PDB viewer
10. Web lab viewer and Rasmols

### **MB 458: Practical – VIII**

1. Laboratory rules, safety regulations and first aid
2. Verification of Beer's Law
3. pH, pK, Henderson: ps- Hassel Bach equation
4. Preparation of Buffers
5. Separation of Amino acids by Paper chromatography
6. Separation of Amino acids by TLC
7. Precipitations of proteins by salts
8. Precipitations of salts by solvents

9. Dialysis of proteins
10. Study of electrophoresis unit

## **MB 459: SEMINAR /ASSIGNMENT**

### **THIRD SEMESTER**

#### **Choice Based Course**

#### **Microbiology – concepts and applications**

**Paper: MB 501**

**56hr**

#### **UNIT – I**

**14hrs**

History and development of microbiology. Role of microorganisms in nature. Isolation and culture of microorganisms, culture media and preservation of culture. Staining techniques: principle, procedure and types-simple, negative sterilization techniques: physical and chemical methods

#### **UNIT – 2**

**10hrs**

General features of Algae, Protozoans and Virus. Ultrastructure of Bacteria, Genetic recombination in Bacteria, Genetic analysis of microbes – plasmids, transposons of bacteriophages, Genetic mutation and its types.

#### **UNIT – 3**

**16hrs**

Study of fermenters – design and types. Biofertilizers – importance and mass culturing of Rhizobium, Azotobactor, Cyanobacteria and mycorrhizae, carrier based inoculants. Bio- control agents – types and their application. Bioremediation of contaminated soils.

#### **UNIT – IV**

**16hrs**

Contamination and spoilage of foods – Cereals, vegetables and fruits, Meat and Milk products, preservation methods of food. Fermented food – Bread, Vinegar, sausages, sour cream, cheese, sauerkraut and ensilage. Microbiology and potable water – contamination, testing and purification. Microbes in air – importance, Types and air sampling techniques, Bio-indicators integrated management of water, soil and air pollution

**PAPER: MB502**

**MOLECULAR BIOLOGY**

**56hrs**

**UNIT – I**

**12hrs**

Introduction to central dogma of molecular biology. Historical aspects and current concept of nucleic acid DNA structure. DNA – replication: prokaryotic and eukaryotic, Enzymology and control of DNA replication, replication intermediates – inhibitors of replication. Transcription – prokaryotic and eukaryotic, Eukaryotic promoters, enhancers, transcription factors, various protein motifs involved in DNA – protein interaction during transcription. RNA processing, Modification in RNA editing, different modes of Mrna, Trna and Rrna splicing. Synthesis of different RNA molecules

**UNIT – II**

**14hrs**

Translation in prokaryotes and eukaryotes, post translational modifications and intracellular transport of proteins, protein splicing, inhibitors of translation, translational control mechanism. Regulation of gene expression in prokaryotes and eukaryotes, operon concept, catabolic repression, repressible enzyme systems, control by attenuation, gene regulation in eukaryotes, transcriptional regulation, post transcriptional regulation environmental regulation of gene expression

**UNIT– III**

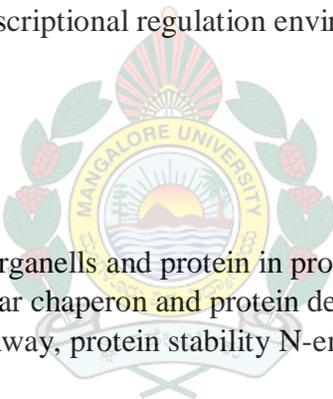
**12hrs**

Protein sorting and targeting: cell organells and protein in protein sorting, signal hypothesis, signal recognition particle, molecular chaperon and protein degradation. lysosomal degradation, PEST sequence, the ubiquitine pathway, protein stability N-end rule

**UNIT – IV**

**18hrs**

Molecular biology of cancer: mechanism of transformation of cells. Physical and chemical carcinogenic agents, viral and cellular oncogenes, tumour repressor genes, telomerases and their role in cancer. Repair of DNA : direct transversal damage, Excision repair, recombinant repair, SOS repair, Mismatch repair, identification of caecinogen



**PAPER: MB 503 INDUSTRIAL MICROBIOLOGY 56hrs**

**UNIT – I 12hrs**

Isolation and screening of industrially important microbes, improvement of strains for increased yield, Mutation, Selection, Genetic recombination, Protoplast fusion technology, metabolic control mechanisms, primary and secondary metabolites. Preservation and maintenance of industrially important microbes.

**UNIT – II 14hrs**

Kinetics of fermentation process : batch and continuous fermentation, productivity and product formation. Rheological properties of feed stock, intermediate biological, Newtonian and Non Newtonian fluids, plastic fluids, Apparent Viscosity, Foam and Antifoam, heat transfer coefficients, mass transfer resistance, gas transfer coefficient.

**UNIT – III 14hrs**

Design of fermenters – CSTB, Air, lift bioreactor, continuous flow bioreactor. Koji reactor, immobilized cell reactor, Auxiliary instrumentation of bioreactor and sealing up of fermentation media formulation – feed stock, design of new feedstock, C/N ratio, C/P ratio and P/O ratio, large-scale sterilization, batch and continuous systems

**UNIT – IV 16hrs**

Down stream processing – cell separation, cell disintegration and recovery, filtration and reverse osmosis, formulations, spray drying, drug drying, drum drying, freeze drying and fuller materials. Basic concepts of quality control, quality validation and quality assurance. Economic aspects of bioprocesses, microprocessor controlled systems. Response surface methodology in feed stock design and fermentation parameter optimization.

## **PAPER: MB -504 IMMUNOLOGY AND MEDICAL MICROLOGY 56hrs**

### **UNIT – I**

**12hrs**

Basic concepts of immunology: immune responses: innate and acquired immunity, humeral and cellular immunity, structure, composition and function of cells and organs involved in immune system. Antigens, structure and properties of antigens, types Iso and Allo, Haptens, adjuvants, antigen specificity.

### **UNIT – II**

**10hrs**

Immunoglobulin : structure and properties, types and Heterogeneity, theories of antibody production, monoclonal and polyclonal antibodies. Antigen and antibody reactions: types and application in disease diagnosis and biochemical search.

### **UNIT – III**

**16hrs**

Tumour immunology: Tumour specific and immunes response to tumours

Histocompatibility: Tissue typing, methods and tissue transplantations in humans, Graft V/S host reaction and rejection, autoimmunity. Hypersensitivity :type 1, type II, type III, type IV immunological methods for the detection of allergens and allergy. Design of vaccines: Lambda, DNA vector, genetically engineered vaccine(TB and Leprosy) antisense RNA based vaccine.

### **UNIT – IV**

**18hrs**

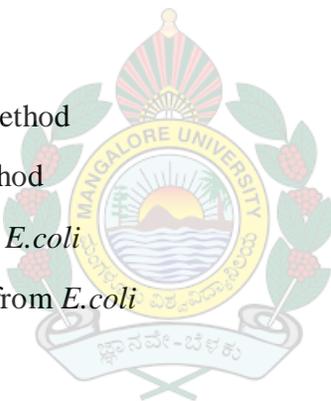
Microbial toxins- Exo and Endo Toxins. Isolation, cultivation and identification of pathogens rapid diagnostic kits. Microbial pathogens and their virulence, infect-ability and virulence, Host resistance, opportunistic and true pathogens, Toxigenicity and Invasiveness. Important microbial human diseases: TB, Tetanus, Diarrhea, Dysentery, Malaria, Gonorrhoea, AIDS, Herpes, plague, Pneumonia and Tetanus Hepatitis. A brief account of antimicrobial compounds and their mode of action microbial resistance to anti microbial compounds.

### **MB 505: Practical – IX**

1. General laboratory rules and bio safety measures (pollutants and toxic materials, chemicals, inflammables)
2. Study of instruments- Microscope, Autoclave, Incubator, Laminar air flow, colony counter and hot air oven.
3. Preparation of Media- simple and differential media
4. Study of inoculation methods and colony characteristics
5. Staining techniques- simple, negative, and gram staining
6. Study of Haemocytometer and micrometry
7. Isolation and identification of bacteria and fungi from different sources (soil, water, food items)
8. Determination of soil moisture content
9. Estimation of soil organic carbon by chromic acid method
10. Tests for coliforms of water
11. Quality assessment of milk by MBRT and DMC method

### **MB 506: Practical – X**

1. Estimation of RNA by Orcinol method
2. Estimation of DNA by DPA method
3. Isolation of Genomic DNA from *E.coli*
4. Estimation of the isolated DNA from *E.coli*
5. Isolation of Plasmid DNA
6. Extraction of DNA from Yeast
7. Transformation of Bacteria
8. Demonstration of Transduction in Bacteria
9. Agarose gel electrophoresis
10. The Ames test



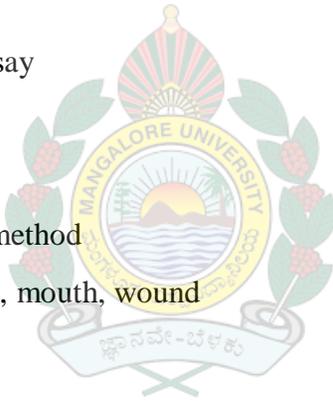
### **MB 507 Practical – XI**

1. Isolation of Amylase producing microbes from soil
2. Production and Estimation of Amylase
3. Stability of amylase for temperature, pH, substrate
4. Production of citric acid

5. Production of wine
6. Estimation of Reducing sugar in wine
7. Estimation of polyphenols in wine
8. Penicillin production & production of antimicrobial activity
9. Estimation of alcohol % by Specific gravity method
10. Production and estimation of Bacteriocin

### **MB 508: Practical – XII**

1. Detection of Allergens Pollen count by sticky slide method
2. Study and Characterization of Lymphocytes
3. Blood group determination
4. Radial immunodiffusion assay
5. Ouchterlony double diffusion assay
6. DOT – ELISA
7. SDS – PAGE
8. Rocket immunoelectrophoresis method
9. Isolation of microflora from skin, mouth, wound
10. Synder's test for dental decay



## **FOURTH SEMISTER**

**PAPER: MB551 AGRICULTURAL MICROBIOLOGY 56HRS**

### **UNIT-1 14hrs**

Biochemical cycles : nitrogen, phosphorous, sulphur and carbon. Biochemistry of nitrogen fixation, symbolic and non-symbolic enzyme system and energetic, estimation of nitrogen fixation. Composition of soil mineral and organic contents, water & gases, types of soil. Qualitative and quantitative analysis of soil micro flora-bacteria, fungi, nematodes, algal and protozoa. Importance of soil analysis for agriculture; sampling, preliminary field test, sample preparation.

### **UNIT-II 14hrs**

Organic matter decomposition-cellulose, hemicellulose, lignin and polyphenols degradation. Microbial inoculants-Rhizobium, Azospirillum, Azotobacter, cyanobacteria. Azolla and Mycorrhizae, mass culturing of inoculants-liquid inoculants and carrier-based inoculants, types of carriers. Microbial diversity in soil. Methods for isolation of micro-organisms soil.

### **UNIT- III 14hrs**

ISI standards and quality tests, methods of inoculants in seed coating, pre inoculated seeds, soil inoculants and nursery inoculants. Impact of heavy metals in soil microbial communities.

### **UNIT- IV 14hrs**

Bio control of weed micro-organisms, biochemical mechanism of control of insect pests by bacillus thuringiensis, Bacillus popilliae, Beauveria bassiana, Cephalosporium acremonium. Biocontrol of plant pathogen by Trichoderma reesei production, formulation & application & biocontrol agents, survival of the bio control agents. Bioremediation of contaminated soils. Application and bio control agents, survival of the bio control agents. Bioremediation of contaminated soils.

**PAPER: MB552 ENVIRONMENTAL MICROBIOLOGY 56HRS**

**UNIT-I 14hrs**

Microbiology of potable water, contamination of drinking water testing by MPN method , water purification for potable and bottled waters, standard test and quality assurance . Sewage water measurement of pollution, BOD, COD. Wastage water treatment-Trickling filter , oxidation ponds, oxidation lagoons, activated sludge processing and anaerobic digesters.

**UNIT-II 14hrs**

Water borne diseases. Integrated management of water. Microbial degradation of pesticides, ,endosulphan , DDT, Melathion , thiram. Biodegradation of hydrocarbons, biodegradation of detergents. Pollution assessment and use of microorganisms in bio remediation.

**UNIT-III 14hrs**

Soil pollution- nature of pollutants, microorganisms as indicators and scavengers, biomagnification and accumulation. Long distance and short distance dispersal of plant diseases, plant diseases and forecasting. Biodegradation-Microbial degradation of herbicides-2,4 D and paraquant. Integrated management of soil pollution.

**UNIT-VI 14hrs**

Air pollutants – types of pollutants , air sampling and purification techniques- gravity sedimentation methods, thermal precipitation, electrostatic precipitation. Pressure precipitation techniques(Anderson’s sampler, Hand held sampler) advantages and limitations. Identification of air borne particles, air spora of enclosed environment, crop fields. Infection by inhalation and allergy, air hygiene. Integrated management of air.

**PAPER:MB 553      FOOD AND DIARY MICROBIOLOGY      56 HRS**

**UNIT-I**

**14hrs**

Food as a substrate for microorganisms. Microbes importance in food methods, yeast and bacteria. Factors influencing microbial growth. Extrinsic and intrinsic factors. Chemical preservatives and food additives. Contamination and spoilage: cereals, sugar products, vegetables , fruits meat and its products, fish & sea foods, poultry, spoilage of canned foods.

**UNIT-II**

**14hrs**

Detection of spoilage and characterization. Food borne infections and intoxication. Bacterial, non-Bacterial. Brucella, Clostridium, Shigella, Staphylococcus, Yersinia, Nematodes, Protozoa, Fungi. Food borne outbreaks. Food preservation: Classification & importance, Principles. Aseptic removal of microbes: Anaerobic, High temperature, drying. Canning: D,Z,F values.

**UNIT-III**

**14hrs**

Lab testing procedures: Preservation measures. Food sanitation and manufacture and retail trade. Food control agencies regulations, employees health standard. Waste treatments, Disposal. QC. Food laws & Regulations. FOOD fermentation: Bread, cocoa, Vinegar, Sausage, Ensilage. Oriental fermented food : idly.

**UNIT -IV**

**14hrs**

Milk Handling & processing, microbial contamination of milk, preservation of milk. Pasteurization: HTST system. Biochemical Activity of milk: souring, Lactosis ,proteolytic Activity, Milk Fermentation & spoilage. Milk borne infections. Fermentation of diary product: Butter milk, Sour cream, cheese, yoghurt, their quality standards.

**UNIT-I****14hrs**

Use of bacteria & virus in biotechnology and genetic engineering. Biocatalysts: Principles and production of amylase, proteases, lipases, pectinases and restriction enzymes. Microbial production of single cell protein and fusion proteins. Lactic acid bacteria as probiotics, production of probiotics compounds and LAB, role of probiotics in controlling infection.

**UNIT-II****14hrs**

Production of amino acid, hormones, nucleoside, steroid hormones. Synthesis, production and uses of biopolymers- chitin, Xanthan, and pullulan. Microbial production of industrial chemicals: wine, beer, alcohol, lactic acid, citric acid, vinegar, gluconic acid. Biopesticides: Bacterial, fungi, and viral pesticides, production and formulation protocols.

**UNIT-III****14hrs**

Microbes as Biofertilizer. Biofuels-Production of hydrogen, Biogas-improvements of strains, biogas from liquid wastes and solid wastes, design of biogas reactors. Principles, methods, problems and prospects with reference to microbial biotechnology. Geomicrobiology: Ore leaching, production of low sulphur coal, reclamation of mine sites. Petroleum microbiology: use of whole cell and microbial metabolites in ballasting of ships and extraction of oil.

**UNIT-IV****14hrs**

Patent laws and IPR: Salient features of Indian international laws, IPR and copy write.

Filing of a patent, patent regulations governing microbes and industrial process.

Release of GEM- concepts and international protocols for the release of genetically engineered microorganisms.

**MB 555: PRACTICALS – XIII**

1. Determination of soil moisture content
2. Determination of ammonification in soil
3. Determination of nitrification in soil
4. Interaction studies of Rhizosphere micro flora by slide burial method
5. Isolation and identification of Rhizobium from root nodules
6. Isolation and identification of free nitrogen fixators
7. Isolation and identification of PS organisms
8. Testing sps specificity of rhizobium

9. Estimation of OC chromic acid method & titrimetric acid
10. Estimation of inorganic phosphate by AAM method

### **MB 505 : Practical IX**

1. Production of secondary metabolites from microbes
2. Partial purification of microbial enzymes by ion exchange, affinity chromatography, electrophoresis, spectrophotometer analysis
3. Estimation of vitamin C
4. Study on biofuels producing microorganisms
5. Antimicrobial activity of microbes
6. Studies on nutritive quality of algae / microbes, protein, nuclear acid
7. Enzyme immobilization
8. VDRL/WIDAL test
9. Studies on endophytic microorganisms
10. Studies on plant defense related compounds/enzymes against microorganisms
11. Western blotting analysis of microorganisms
12. Cultivation of mushrooms

### **MB 556: PRACTICAL – XIV**

1. Determination of TDS of water
2. Determination of TD of water
3. Determination of BOD of water
4. Determination of COD of water
5. Microbial analysis potable water – MPN method
6. Test for coliforms in water
7. Isolation of indicator algae from polluted water
8. Isolation of oil degrading microbes
9. Air sampling technique
10. Enumeration of lichens

### **MB 557: PRACTICAL – XV**

1. Enumeration of milk Micro flora by DMC
2. MBRT for milk
3. Production and evaluation of curd
4. Estimation of lactic acid
5. Milk spoilage microbes
6. Production and evaluation of idly

7. Test for food adulteration
8. Effect of food preservatives
9. Isolation and identification of spoilage microbes from vegetables, fruits, pickles
10. Effect of food preservatives on lime squash & its MIC

## **MB 558: PROJECT WORK**

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