

M.S. RAMAIAH COLLEGE OF ARTS, SCIENCE AND COMMERCE

Course Outcomes for Msc(Micro Biology) Program

	Program	CourseCode	CourseName	COCode	CO
	M.Sc Microbiology	MBH101	Bacteriology and Viology	CO1	Student is introduced to Microbiology, the classification and recent trends in taxonomy. The concepts of bacterial phylogeny and construction of phylogenetic trees.
	M.Sc Microbiology	MBH101	Bacteriology and Viology	CO2	The details of morphology and ultrastructure of bacteria. The characteristics, ultrastructure and significance of Cyanobacteria.
	M.Sc Microbiology	MBH101	Bacteriology and Viology	CO3	Morphological characteristics of different groups of bacteria such as Mycoplasma, Archaeobacteria, Actinomycetes, Rickettsia.
	M.Sc Microbiology	MBH101	Bacteriology and Viology	CO4	Learn in details with examples the nutritional requirements, cultivation media for microbes. Microbial growth kinetics and factors affecting growth, mechanism of cell cycle in bacteria.
	M.Sc Microbiology	MBH101	Bacteriology and Viology	CO5	
	M.Sc Microbiology	MBH101	Bacteriology and Viology	CO6	Write down in depth the various methods of cultivation of bacterial and animal viruses and their assay methods.
	M.Sc Microbiology	MBH102	Eukaryotic Microbiology	CO2	Understand the classification and characteristics of Protozoa with few examples and cultivation methods
	M.Sc Microbiology	MBH102	Eukaryotic Microbiology	CO3	Deliberate the details of Fungal cell, spores, mechanism of growth, cultivation and prevention of fungal growth
	M.Sc Microbiology	MBH102	Eukaryotic Microbiology	CO4	Write down the characteristics of General features, diversity, Ainsworth system of classification, structure, reproduction and significance of Allomyces, Claviceps, Puccinia, Fusarium
	M.Sc Microbiology	MBH102	Eukaryotic Microbiology	CO5	understand the different Substrate groups: saprophytic, parasitic, keratinophilic, coprophilous; substrate successions, parasitism, predation, mutualism and symbiosis with plants and animals. Diversity of aquatic fungi. Economic importance of fungi.
	M.Sc Microbiology	MBH102	Eukaryotic Microbiology	CO6	Write down in depth Isolation and cultivation of algae invitro and mass production of algae
	M.Sc Microbiology	MBH102	Eukaryotic Microbiology	CO7	Understand the details of Role of algae as Food, therapeutics, biofuels, heavy metals removal
	M.Sc Microbiology	MBH102	Eukaryotic Microbiology	CO1	Understand in detail the general feature, classification, diversity, stucture, reproduction and significance of Algae.
	M.Sc Microbiology	MBH103	Microbial Phyosology & Biochemistry	CO1	Metabolism and Bioenergetics

M.Sc Microbiology	MBH104	Microbial & Biochemical Techniques	CO1	
M.Sc Microbiology	MBP106	Bacteriology , Viology &Eukaryotic Microbiology	CO9	understand the mechanism of Growth in fungi-linear and biomass
M.Sc Microbiology	MBP106	Bacteriology , Viology &Eukaryotic Microbiology	CO1	Specify in depth Isolation of microorganism:Serial dilution, pure culture techniques
M.Sc Microbiology	MBP106	Bacteriology , Viology &Eukaryotic Microbiology	CO10	Understand in depth effect of pH, temperature, and nutritional factor on growth of fungi
M.Sc Microbiology	MBP106	Bacteriology , Viology &Eukaryotic Microbiology	CO12	Learn the details of Isolation of algae from soil and water
M.Sc Microbiology	MBP106	Bacteriology , Viology &Eukaryotic Microbiology	CO12	Learn the details of Isolation of Protozoa from soil and water
M.Sc Microbiology	MBP106	Bacteriology , Viology &Eukaryotic Microbiology	CO2	Understand the characteristics of Culturing and cultural characteristics of microorganisms
M.Sc Microbiology	MBP106	Bacteriology , Viology &Eukaryotic Microbiology	CO3	Specify the classification and characteristics of Staining techniques:Simple, Differential:acid-fast, endospore, capsule, cell wall, cytoplasmic inclusions vital stains: flagella, spore and nuclear staining
M.Sc Microbiology	MBP106	Bacteriology , Viology &Eukaryotic Microbiology	CO4	Deliberate in details with examples Biochemical tests for identification of Bacteria, Identification of bacteria by API system
M.Sc Microbiology	MBP106	Bacteriology , Viology &Eukaryotic Microbiology	CO5	Specify the details of Bacterial growth measurement(cell count, turbidometry, plate count)
M.Sc Microbiology	MBP106	Bacteriology , Viology &Eukaryotic Microbiology	CO6	Deliberate the technique of Isolation of bacteriophages from sewage and flies
M.Sc Microbiology	MBP106	Bacteriology , Viology &Eukaryotic Microbiology	CO7	Learn in detail the different methods of Isolation of fungi from soil:Dilution plate method, Warcup method, stamping method.

M.Sc Microbiology	MBP106	Bacteriology , Viology &Eukaryotic Microbiology	CO8	Learn the different methods of Isolation of fungi from plant material
M.Sc Microbiology	MBT401	Microbial Phyosology & Biochemistry, MicrobialTech niques	CO2	learn in detail of isolation,characterisation and preservation of purecultures
M.Sc Microbiology	MBT401	Microbial Phyosology & Biochemistry, MicrobialTech niques	CO2	study principle and application of different types of microscopes.
M.Sc Microbiology	MBT401	Microbial Phyosology & Biochemistry, MicrobialTech niques	CO3	Learn about direct and indirect methods of measurement of microbial growth.
M.Sc Microbiology	MBT401	Microbial Phyosology & Biochemistry, MicrobialTech niques	CO4	analysis of metagenomics
M.Sc Microbiology	MBT401	Microbial Phyosology & Biochemistry, MicrobialTech niques	CO5	Understand the principle and application of spectroscopy.
M.Sc Microbiology	MBT401	Microbial Phyosology & Biochemistry, MicrobialTech niques	CO6	learn indetail principle and application of chromatography.
M.Sc Microbiology	MBT401	Microbial Phyosology & Biochemistry, MicrobialTech niques	CO7	study isotope techniques
M.Sc Microbiology	MBH201	Microbial Genetics	CO1	Specify in depth the structure of prokaryotic genome and E.coli chromosome.
M.Sc Microbiology	MBH201	Microbial Genetics	CO2	Deliberate in details the structure and organization of eukaryotic genome. Histone modifications and their effects on chromosome structure and function. The different types of DNA sequences, law of DNA constancy , genome size and C-value paradox.

M.Sc Microbiology	MBH201	Microbial Genetics	CO3	Understand in depth Molecular basis of spontaneous and induced mutations and their role in evolution; mutagens, types of mutations, Ames and other toxicity testing.
M.Sc Microbiology	MBH201	Microbial Genetics	CO4	Understand in detail Genetic recombination in bacteriophages and E. coli. Homologous recombination, role of RecA and other recombinases, generalized & specialized transduction, transformation and conjugation.
M.Sc Microbiology	MBH201	Microbial Genetics	CO5	Deliberate in depth mechanisms and applications of bacterial transformation; Host cell restriction; Transduction; complementation; conjugation and transfection. Genetics of fungi-alteration of generation, induction of mutation in Neurospora crassa and yeast, cytoplasmic inheritance and biochemical mutants.
M.Sc Microbiology	MBH201	Microbial Genetics	CO6	Deliberate in details with application, Plasmids- description, types and their uses in genetic analysis. Bacteriophages, Lysogeny and lytic cycle in bacteriophages, and their uses in microbial genetics.
M.Sc Microbiology	MBH202	Molecular Biology	CO6	Learn in details with examples Control of gene expression at transcription and translation level, gene silencing
M.Sc Microbiology	MBH202	Molecular Biology	CO5	Specify in details with examples regulation of gene expression and operon concepts
M.Sc Microbiology	MBH202	Molecular Biology	CO3	Deliberate in depth Transcription in prokaryotes and eukaryotes
M.Sc Microbiology	MBH202	Molecular Biology	CO4	Deliberate the classification and characteristics of Translation in prokaryotes and eukaryotes and post translational modifications
M.Sc Microbiology	MBH202	Molecular Biology	CO2	Write down in depth DNA replication in prokaryotes and eukaryotes
M.Sc Microbiology	MBH202	Molecular Biology	CO1	Structure DNA & RNA . Mechanisms of DNA damage and repair
M.Sc Microbiology	MBH203	Environment Microbiology	CO1	Aerobiology- Air spora in different layers of atmosphere, bioaerosol, assessment of air quality using principles of sedimentation, impaction, impingement, suction and filtration. Brief account of transmission of airborne microbes; Microbiology of indoor and outdoor. Allergy: Causes and tests for detection of allergy.
M.Sc Microbiology	MBH203	Environment Microbiology	CO2	Aquatic Microbiology: Fresh and marine ecosystem (estuaries, mangroves, deep sea, hydrothermal vents, salt pans, coral reefs). Zonation of water ecosystem; upwelling, eutrophication; food chain in aquatic ecosystems. Role of methanotrophs in ecosystem. Potability of water, microbial assessment of water, water purification. Ground water types and their contamination. Biofilm. Waste treatment: sewage and effluent

					treatment; primary, secondary and tertiary treatment, Solid waste treatment. Solid wastes as sources of energy and food.
M.Sc Microbiology	MBH203	Environment Microbiology	CO3		Soil Microbiology: Biotic and abiotic interactions, concepts of habitat and niche. Microbial communities; nature, structure and attributes, levels of species diversity, succession and stability, r and K selection, genetic exchange between communities. Biodiversity management and conservation. Role of microbes in organic solid waste treatment matter in various soil types, subterranean microbes. Biogeochemical cycles of carbon, nitrogen, phosphorous and sulphur.
M.Sc Microbiology	MBH203	Environment Microbiology	CO4		Diversity in anoxic eco system: Methanogens-reduction of carbon monoxide- reduction of iron, sulphur, manganese, nitrate and oxygen. Microbial transformations of Carbon, Phosphorus, Sulphur, Nitrogen and Mercury.
M.Sc Microbiology	MBH203	Environment Microbiology	CO5		Extremophiles: The domain Archaea, acidophilic, alkalophilic, thermophilic, barophilic and osmophilic and radiodurant microbes- mechanisms and adaptation. Halophilic- membrane variation- electron transport- application of thermophiles and extremophiles. Extremozymes. 6hrs Unit 6 Biodegradation: Role of microbes in degradation, Biodegradation of Xenobioticshydrocarbons, pesticides and plastics. Biodeterioration of wood, pulp and paper; Biosorption/bioaccumulation of heavy metals. Bioremediation of soil, air and water: various methods, advantages and disadvantages. Bioleaching of iron, copper, gold and uranium.
M.Sc Microbiology	MBH204	Food Microbiology	CO7		
M.Sc Microbiology	MBH204	Food Microbiology	CO1		Write down the details of Introduction: Development of food microbiology as a science, scope of food microbiology. Food as substrate for microorganisms, intrinsic and extrinsic factors affecting the growth of microbes, important microorganisms in food (molds, yeasts and bacteria) and their source (air, soil, water, plants and animals).
M.Sc Microbiology	MBH204	Food Microbiology	CO2		Write down in depth Food contamination and spoilage: Sources of food contamination. Principles of food spoilage; spoilage of cereals, sugar products, vegetables, fruits, meat and meat products, milk and milk products, fish and sea foods, poultry; spoilage of canned foods; conventional and modern methods for detection of spoilage and characterization
M.Sc Microbiology	MBH204	Food Microbiology	CO3		Write down the details of Food-borne infections and intoxication: Bacterial- Brucella, Bacillus, Clostridium, Escherichia, Listeria; Food intoxication- Botulism, Staphylococcal. Mycotoxins & their types – aflatoxins, ochratoxins, fumosins, trichothecenes, zealenone, ergot alkaloids; food borne outbreaks and lab testing procedures. Preventive measures. Molds, Algae, Protozoa, Viruses.

M.Sc Microbiology	MBH204	Food Microbiology	CO4	Specify in depth Food preservation: Principles and methods of food preservation- Physical (temperature, irradiation, drying, canning, processing for heat treatment-D, Z and F values) Chemical (Organic acids, food additives. Class I and Class II preservatives), Biopreservation (Lactic acid bacteria). Food Packaging- Types of packaging materials, properties and benefits.
M.Sc Microbiology	MBH204	Food Microbiology	CO5	Learn in depth Microbial and Fermented foods: SCP- Nutritional & therapeutic importance, Quorn and SCO and their Industrial production. Fermented Vegetables (olives, cucumbers), Meat (sausages), Beverage (cocoa and coffee); Bread, Idli, Dairy foods (cheese, srikhand). production methods of Kefir, Yogurt, Acidophilus milk; Probiotics, Prebiotics and Synbiotics, Nutraceuticals (Cr/Se yeast), functional foods and their quality standards. Application of fungal pigments in food industry.
M.Sc Microbiology	MBH204	Food Microbiology	CO6	Deliberate in details with examples Food and sanitation: Good Hygiene Practices, Sanitation in manufacture and retail trade; food control agencies and their regulation, hazard analysis and critical control points (HACCP); GMP, plant sanitation – employees' health standard, waste treatment, disposal, quality control. Recent trends and development in food technologies in India.
M.Sc Microbiology	MBS205	BioInformatics	CO1	Specify the details of Introduction to computer
M.Sc Microbiology	MBS205	BioInformatics	CO2	Specify in depth Computer Network and Programming Languages
M.Sc Microbiology	MBS205	BioInformatics	CO3	Deliberate the characteristics of Relational Databases Management
M.Sc Microbiology	MBS205	BioInformatics	CO4	Identify the classification and characteristics of biological databases, sequence analysis methods
M.Sc Microbiology	MBS205	BioInformatics	CO5	Understand the characteristics of Protein Structure and Molecular Interaction
M.Sc Microbiology	MBP206	Microbial Genetics & Molecular Biology	CO1	Learn the details of Basic techniques of microbial genetics and molecular biology
M.Sc Microbiology	MBP207	Environment Microbiology & Food Microbiology	CO1	Various techniques and methods of microbial analysis of food and environment
M.Sc Microbiology	MBH303	Immunology	MBH303 UNIT1	Immune system and Immunity

M.Sc Microbiology	MBH303	Immunology	MBH30 3UNIT2	Antigen and Antibodies
M.Sc Microbiology	MBH303	Immunology	MBH30 3UNIT3	Antigen Antibody reactions
M.Sc Microbiology	MBH303	Immunology	MBH30 3UNIT4	Hypersensitivity reactions
M.Sc Microbiology	MBH303	Immunology	MBH30 3UNIT5	Major histocompatibility complex
M.Sc Microbiology	MBH303	Immunology	MBH30 3UNIT6	Immunization
M.Sc Microbiology	MBH303	Recombanent DNA Technology	CO3	methods of cloning in prokaryotes and eukaryotes and DNA libraries
M.Sc Microbiology	MBH303	Recombanent DNA Technology	CO4	Understand the principles of molecular techniques and applications
M.Sc Microbiology	MBH303	Recombanent DNA Technology	CO5	Learn the methods of DNA sequencing and mapping of genes
M.Sc Microbiology	MBH303	Recombanent DNA Technology	CO6	learn the principles of chemical and enzymatic synthesis of genes with examples
M.Sc Microbiology	MBH303	Recombanent DNA Technology	CO7	Applications of recombinant DNA technology in various field
M.Sc Microbiology	MBH303	Recombanent DNA Technology	CO2	tools of genetic engineering and different types of vectors
M.Sc Microbiology	MBP306	Recombanent DNA Technology & BioInformatics	CO1	Understand in depth basic techniques of recombinant DNA technology
M.Sc Microbiology	MBH401	Agricultural Microbiology	CO2	Write down the characteristics of Biological Nitrogen Fixation- Symbiotic, nonsymbiotic, Associative nitrogen fixation mechanisms, genes involved, Nif gene, Nod factor, noduline genes, Genetic engineering of Biological Nitrogen Fixation
M.Sc Microbiology	MBH401	Agricultural Microbiology	CO3	Understand in depth Plant-Microbes interactions
M.Sc Microbiology	MBH401	Agricultural Microbiology	CO4	Deliberate in depth Bioinoculants: Biopesticides and Biofertilizer -types, production and quality control. Cultivation and mass production of bioinoculants-

M.Sc Microbiology	MBH401	Agricultural Microbiology	CO5	Identify in depth Molecular Plant Pathology- Recognition of host, entry, role of enzymes, toxins, R and r genes, phytotoxins, Phytoalexins, PR proteins, plant defense mechanisms against pathogens, Transgenic approaches for crop protection
M.Sc Microbiology	MBH401	Agricultural Microbiology	CO6	Learn the characteristics of Plant diseases-Symptomatology, etiology & control of Fungal, viral, Bacterial, mycoplasma, viroidal diseases
M.Sc Microbiology	MBH401	Agricultural Microbiology	CO1	Identify the characteristics of Microbes in Soil fertility, decompositon, effect of pesticides on soil
M.Sc Microbiology	MBH403	Microbial Biotechnology	CO4	Write down in details with application, if applicable, Microbial transformation and organic synthesis: Transformation of steroids and sterols, over production of glutathione by genetically engineered cells. Metabolic engineering for vitamin C production, synthesis of acrylamide by nitrile hydratase, synthesis of optically pure drugs.
M.Sc Microbiology	MBH403	Microbial Biotechnology	CO5	Identify the details of Nanotechnology: Introduction, Tools of nanosciences, Synthesis of Nanomaterials using microbes. Biopolymeric nanoparticles; nanosensors, biomedical applications, antimicrobial nanoparticles.
M.Sc Microbiology	MBH403	Microbial Biotechnology	CO6	Identify the characteristics of Bioethics and biosafety: Introduction, Human genome project and its ethical, legal and social implications. Biosafety guidelines and regulations for GMOs. GLP and GMP. Labelling of GM products. Ethics and safety of GM food. Testing of drugs on human volunteers.
M.Sc Microbiology	MBH403	Microbial Biotechnology	CO2	Understand the classification and characteristics of Microbial products for commercial use: Industrial production of organic acids (acetic acid, lactic acid). Amino acids (lysine, glutamic acid), Solvents (acetone, ethanol), Antibiotics (Cephalosporin, Streptomycin), Microbial polysaccharides (xanthan) and polyesters (PHB). Hormones (insulin), anticholesterol compound (Lovastatin). Vaccines (recombinant). Microbial insecticides. Secondary metabolites in bacteria and fungi (anti-cancer and antidiabetic compounds).
M.Sc Microbiology	MBH403	Microbial Biotechnology	CO3	Deliberate in details with examples Microbial enzymes: Industrial production of lipase, protease & asparaginase. Enzymes in - starch processing, food, textile, detergent, leather, breweries, pharmaceuticals, therapeutics, and diagnostics. Recombinant enzymes. Immobilized enzymes and cells: Techniques and types of immobilization, industrial applications of immobilization: merits and demerits.
M.Sc Microbiology	MBH403	Microbial Biotechnology	CO1	Specify the characteristics of Introduction: Principle, applications, economics and milestones in microbial technology
M.Sc Microbiology	MBH-301	Medical Microbiology	CO4	understand indetail the etiology, clinical symptoms, laboratory diagnosis and treatment of bacterial and protozoan diseases.

M.Sc Microbiology	MBH-301	Medical Microbiology	CO5	study in detail the etiology, clinical symptoms, laboratory diagnosis and treatment of fungal diseases.
M.Sc Microbiology	MBH-301	Medical Microbiology	CO6	understand classification and mechanism of antimicrobial agents, study of vaccines and probiotics as therapeutic agents
M.Sc Microbiology	MBH-301	Medical Microbiology	CO2	Deliberate in detail the etiology, clinical symptoms, laboratory diagnosis and treatment of viral diseases.
M.Sc Microbiology	MBH-301	Medical Microbiology	CO3	Understand the details of principles and applications of various immuno and molecular diagnostic methods in microbiology
M.Sc Microbiology	MBH-301	Medical Microbiology	CO1	Specify the characteristics of normal microflora of the human body and its significance. The detailed mechanism of infection, pathogenesis and mode of transmission of pathogens in diseases.