PALAMURU UNIVERSITY

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

(Applicable to the batch of students admitted into M.Sc. I Sem from 2016-17)

M.Sc. (Previous) Microbiology I Semester (15 Weeks) **(CBCS)**

Paper No.	Sub.Code	Subject/Paper Title	Instruction Hrs/Wk	Exam Max Marks Internal	Semester	Credits
		THEORY				
I	MB 101	General Microbiology	4	20	80	4
II	MB 102	Virology	4	20	80	4
III	MB 103	Research Methodology &Techniques	4	20	80	4
IV	MB 104	Biochemistry	4	20	80	4
		PRACTICALS				
I	MB 151	General Microbiology & Virology	8		100	4
II	MB 152	Research Methodology &Techniques & Biochemistry	8		100	4
	MB 199	Seminar	2			
		Total	34	80	520	24

M.Sc. (Previous) Microbiology II Semester (15 Weeks) **(CBCS)**

Paper No.	Sub.Code	Subject/Paper Title	Instruction Hrs/Wk	Exam Max Marks Internal	Semester	Credits
		THEORY				
I	MB 201	Microbial Physiology & Metabolism	4	20	80	4
II	MB 202	Food Microbiology and Toxicology	4	20	80	4
III	MB 203	Immunology	4	20	80	4
IV	MB 204	Pharmaceutical Microbiology	4	20	80	4
		PRACTICALS				
I	MB 251	Microbial Physiology & Metabolism & Food Microbiology and Toxicology	8		100	4
II	MB 252	Immunology & Pharmaceutical Microbiology	8		100	4
	MB 299	Seminar	2			
		Total	34	80	520	24

Note: The students of M.Sc. Microbiology have to undergo the educational tour to the microbiological based industries/institutes for practical awareness in application of Microbiology at the end of II/IV Semester

M.Sc. (Final) Microbiology III Semester (15 Weeks) **(CBCS)**

Paper No.	Sub.Code	Subject/Paper Title	Instruction Hrs/Wk	Exam Max Marks Internal	Semester	Credits
		THEORY				
I	MB 301	Molecular Biology and Microbial Genetics	4	20	80	4
II	MB 302	Industrial Microbiology	4	20	80	4
III	MB 303	Environmental & Agriculture Microbiology	4	20	80	4
IV	MB 304	Medical Bacteriology	4	20	80	4
		PRACTICALS				
I	MB 351	Molecular Biology and Microbial Genetics & Industrial Microbiology	8		100	4
II	MB 352	Environmental & Agriculture Microbiology & Medical Bacteriology	8		100	4
	MB 399	Seminar	2		25	1
		Total	34	80	545	25

M.Sc. (Final) Microbiology IV Semester (15 Weeks) **(CBCS)**

Paper No.	Sub.Code	Subject/Paper Title	Instruction Hrs/Wk	Exam Max Marks Internal	Semester	Credits
		THEORY				
I	MB 401	Cell and Molecular Biotechnology	4	20	80	4
II	MB 402	Microbial Biotechnology	4	20	80	4
III	MB 403	Medical Virology and Parasitology	4	20	80	4
IV	MB 404	CB Paper	4	20	80	4
		PRACTICALS				
I	MB 451	Cell and Molecular Biotechnology & Microbial Biotechnology	8		100	4
III	MB 452	Medical Virology and Parasitology & Applied Microbiology	8		100	4
	MB 499	Seminar	2		25	1
		Total ...	34	80	545	25

Choice Based Courses in Department of Microbiology, UCS, OU

IV Sem	CB/MB404/1	Microbial Proteomics	4	20	80	4
	2	Microbial Ecology and Plant microbe interactions	4	20	80	4

Note: The students of M.Sc. Microbiology have to undergo the educational tour to the microbiological based industries/institutes for practical awareness in application of Microbiology at the end of II/IV Semester

M.Sc. (Previous) I Semester (CBCS)
Paper I MB 101 General Microbiology (Theory) **(CBCS)**
(4 Units x 15 Hrs = 60 Hrs teaching)

Unit I

History of Microbiology. Microscopy. Structure of microbial cells:
Spontaneous generation and germ theory of disease, Contributions of Antony van Leeuwenhoek, Louis Pasteur, Robert Koch, Edward Jenner, Winogradsky, Beijerinck, Alexander Fleming, Waksman. Developments in modern biology.
Principles and working of bright field microscope, fluorescent microscope, Phase contrast microscope, electron microscope. Application and importance of above microscopes. Measurement of microscopic objects. Prokaryotic cell, Eukaryotic cell, Organization and function of cellular organelles.
Cell wall of bacteria, cell membranes, flagella, pili, capsule structure, chemical structure of peptidoglycan, protoplasts, spheroplasts, microsomes and ribosomal RNAs, Nuclear material/nucleus.

Unit II

Methods of sterilization: Physical methods – Dry heat, moist heat, radiation methods, filtration methods, chemical methods and their application. Concept of containment facility, sterilization at industrial level.
Microbial cultures: Concept of pure culture, Methods of pure culture isolation, Enrichment culturing techniques, single cell isolation and pure culture development.
Preservation and Maintenance of Microbial Cultures: Repeated subculturing, preservation at low temperature, sterile soil preservation, mineral oil preservation, deep freezing and liquid nitrogen preservation, freeze-drying (lyophilization). Advantages and disadvantages of each method.

Unit III

Identification methods and classification of bacteria: -
Microscopic identification characteristics, staining methods – simple staining, differential staining, structural staining and special staining methods.
Ecological identification methods, Nutritional (cultural) identification characters, chemical identification characters, biochemical identification methods, immunological characteristics, pathogenic properties identification, genetic characteristics identification.
Principles of bacterial taxonomy and classification: - Numerical taxonomy, Bergy's manual and its importance, general properties of bacterial groups.
Rickettsiae-General characters and their importance; Mycoplasma – general characters; Chlamydiae – TRIC agents and LGV

Unit IV

Algae, Fungi and their characters:
Distribution of algae, thallus organization, products of algae and their importance. Reproduction, Biochemical classification of algae.
Vegetative body of fungi, reproduction, fruiting bodies and dispersal of fungal propagules. Nutritional groups and habitat relationships of fungi. Economic importance of fungi. Classification of fungi.

I Semester Paper I MB 151 General Microbiology (Practicals) (CBCS)

General instructions, Microbiology laboratory and its discipline
Handling of microscopes, Calibration and measurement of microscopic objects
Staining techniques for bacteria – simple, differential and special stainings
Preparation of media and reagents/stains
Sterilization procedures/methods
Isolation and cultivation of pure cultures
Identification methods of bacteria
Isolation and culturing of fungi (yeasts and molds) and algae
Observation of specimen and permanent slides

Recommended books

Microbiology by Pelczar M.J., Ried, RD and Chan, ECS.
Microbiology by Gerard J. Tortora, Berdell Ra. Funke and Christine L. Case. Publ: Pearson Education Inc.
Text book of Microbiology by M. Burrows
General Microbiology by Stainier, Deudroff and Adelberg
Review of medical microbiology by Jawitz, melnick and Adelberg
Bacterial and Mycotic infections of man. Ed. Dubos and Hirst Lipincott
Principles of Microbiology and Immunology by Davis, Dulbecco , Eison, Ginsberg and Wood.
Structure and Reproduction of Algae, Vol. I & II by Fritsch, F.E.
Introduction to Algae by Morris, I.
Products and Properties of Algae by Zizac.
Fresh water algae of the United States by Smith, GM.
Introductory Mycology, by Alexopolus, C.J.
Dispersal in Fungi by Ingold, CT
Microbial Physiology by Moat,
Laboratory Experiments in Microbiology by Gopal Reddy et al
Microbes in Action by Seoley HW and Van-Demark, PJ
Brock's Biology of microorganisms by Madigan, MT et al

M.Sc. (Previous) I Semester Microbiology (CBCS)
Paper II MB 102 Virology (Theory) **(CBCS)**
(4 units x 15 hrs = 60 hrs teaching)

Unit I

History of virology (latest Scientific investigations), Viral taxonomy (ICTV classification). Virus structure and morphology. Subviral particles-Prions, virusoids, satellite viruses. General idea about cyanophages, actinophages and mycophages. Cultivation of plant and animal viruses. Purification and maintenance of viruses. Quantitation of viruses (viral assays)

Unit II

Structure, Genome organization and Replication strategies of Bacteriophages:
One step growth curve. Lytic ds linear DNA viruses (T4, T7); Lysogenic ds linear DNA virus (Lambda); ss Circular DNA virus (Φ X 174); Male specific filamentous phage (M13)
Structure and Replication strategies of Plant Viruses: TMV , CaMV

Unit –III

Recombination in phages, multiplicity reactivation and phenotypic mixing
General account of Tumor virus (RNA and DNA).
Viral Interference and Interferons. Nature and source of interferons, Classification of interferons. Induction of interferon. Antiviral agents (chemical and biological) and their mode of actions

Unit –IV

Structute and Replication strategies of animal Adeno, Influenza, Retro viruses (HIV) and Hepatitis B.
Viruses as cloning vectors:
Vectors used for cloning and sequencing: λ phage, M 13, retro viruses.
CaMV 35S promoter and its application in genetically modified crops.
Baculovirus System for insect cell lines.

II Semester Paper I MB 151 Virology (Practicals) **(CBCS)**

Isolation of phage from soil/sewage.
Cultivation and preservation of phages
Quantitation of phages
Plaque neutralization
Growth phages of phage and burst size
Isolation of plaque type and host range mutants
Phage induction
Lysogeny-Transduction
Cultivation of animal viruses in egg allantoic, amniotic and CAM
Demonstration of cytopathological changes (slides/pictures)
Symptomatic observations of plant viral infections

Recommended Books

General Virology by Luria and Darnel
Virology and Immunology by Jokli
Text book of Virology by Rhodes and Van Royen
Plant Virology by Smith
Genetics of bacteria and their viruses by W. Hayes
Molecular Biology of the gene by Watson, Roberts, Staitz and Weiner
A laboratory guide in virology by Chjarles H. Lunningham
Basic lab procedures in diagnostic virology by Marty Cristensen
Review of medical microbiology by Jawitz et al
Medical laboratory manual for tropical countries Vol I & II by Monica Cheesbrough
Text Book of Microbiology by Ananthanarayanan and Jayaram Paniker
Viral and Ricketsial infections of Man by Horsfall and Jam
Text book of Virology by Rhodes and Van Royan
Virological Procedures by Mitchal hasking
Virologoy by Wilson and Topley

M.Sc. (Previous) Microbiology I Semester (CBCS)
Paper III MB 103 Research Methodology & Techniques (Theory) **(CBCS)**
(4 units x 15 hrs = 60 hrs teaching)

Unit I

Optical methods:, colourimetry and spectrophotometry, fluorimetry, optical rotation Circular dichroism, NMR, ESR spectroscopy, x-ray diffraction, types of mass spectrometry.

Electrophoretic techniques and application, counter current distribution.

Unit II

Separation methods: Chromatographic techniques – HPLC, FPLC paper, thin layer, ion exchange, gel filtration and affinity chromatography.

Diffusion, dialysis, cell disruption methods, centrifugation techniques, cell free extracts and their use in metabolic studies.

Radio isotopes – detection and measurement of radioactivity – scintillation counters, autoradiography, stable isotopes and their use. Safety precautions. General method of study of intermediary metabolism in microbes. Uses of mutants in study of metabolism.

Unit III

Population, samples and sampling procedures, variables, variations and frequency distributions, measures of central tendency and dispersion, element of probability, gausian or normal distribution, binomial distribution, poisson distribution, 't' distribution, 'F' distribution and Chi-square distribution, correlation and linear regression.

Normal curve test, 't' test, 'F' test, ANOVA, analysis of covariance, Chi-square test, and confidence intervals. Experimental designs using statistical tools.

Unit IV

Introduction to Computers

Introduction to disk operating systems (DOS): Sample commands, DIR-CD-RD-DEL-COPY-MOVE-REN-TYPE-EDIT (Editor) CE-DATE and TIME.

Introduction to Windows: Word Processing: Electronic Spread Sheet

Data collection, Data representation, Manuscript preparation, Research ethics, QA, QC, GLP, GMP, Patents & IPR

I Semester Paper II MB 152 Research Methodology and Techniques (Practicals)
(CBCS)

Creating documents using word processor
Usage of spread sheet to biological applications
Biochemistry calculations and statistics
Absorption maxima of proteins, NA, Aromatic aa and riboflavin.
Differential centrifugation
Paper chromatography: sugars
Dialysis
Demonstration of Gel filtration technique
Demonstration of electrophoresis
Partial purification of enzymes (β-amylase, urease and catalase, alkaline phosphatase)
Effect of substrate concentration, pH, time and temperature on enzyme activity
Calculation of Km for partially purified enzyme
Study for inhibition of enzyme activity

Recommended books

Biochemistry by Lehninger
Outlines of Biochemistry by Cohn and Stumph
Biological Chemistry by Mullar and Cards
Biochemistry by White, Handler and Smith
Methods in Enzymology series
The Cell – Bratch amd Mirsky series
Laboratory experiments in Microbiology by Gopal Reddy et al
Biochemistry lab manual by Jayaraman
Introduction to the theory of statistics by Alexander, M Mood and Franklin
Fundamentals of Biometry by L.N.Balam
Statistical methods by Snedecor and Cochran
Introduction to computer and its application by Chae C.Chien
Basic Programming language by Bajaraman
Biostatistics – A manual of statistical methods for use in Health, Nutrition and Anthropology by K. Vishveshwar Rao

M.Sc. (Previous) Microbiology I Semester (CBCS)
Paper IV MB 104 Biochemistry (Theory) **(CBCS)**
(4 units x 15 hrs = 60 hrs teaching)

Unit I

pH and its biological relevance
Determination of pH, preparation of buffers
Concept of entropy, free-energy, free energy changes, high energy compounds.
Equilibrium constants, Redox potentials, Biological redox systems Biological oxidation, Biological redox carriers, biological membranes, electron transport, oxidative phosphorylation and mechanism.

Unit II

Lipids classification: Bacterial lipids, prostaglandins, structure, function, Major steroids of biological importance.
Carbohydrates: Classification, basic chemical structure, monosaccharides, aldoses, and ketoses, cyclic structure of monosaccharides, steroisomerism, anomers and epimers. Sugar derivatives, deoxy sugars, amino sugars, and sugar acids.
Nucleic acids: Structure and properties of purines, pyrimidines, nucleosides and nucleotides. Metabolism of purines and pyrimidines - Biosynthesis and degradation

Unit III

Proteins and amino acids: Properties of amino acids, structure, confirmation and properties of proteins, metabolism of amino acids, biosynthesis and degradation – an overview.
Enzymes nomenclature, classification methods for determination of enzyme activity. Isolation and purification of enzymes. Enzyme kinetics: Effect of pH, substrate concentration , temperature and inhibitors.

Unit IV

Control of enzymes. Mechanism of enzyme action – Action of Hydrolases, Pencillin acylases, Oxidases and reductases. Coenzyme catalysis(pyridoxal phosphate and TPP). Isoenzymes. Competitive and non-competitive inhibition. Methods for increased microbial enzymes production and activity. Control of enzymes. Regulation of enzyme activity: allosteric enzymes and feed back mechanisms. Metabolic compartmentalization in relation to enzyme, enzymes and secondary metabolites

Semester Paper II MB 152 Biochemistry (Practicals) **(CBCS)**

Safety and good lab practices
Preparation of buffers and adjustment of pH
Qualitative tests for carbohydrates and analysis of unknowns
Qualitative tests for amino acids and analysis of unknowns
Quantitative estimation of inorganic and organic phosphate
Tests for lipids (qualitative)
Quantitative estimation of glucose and fructose
Determination of saponification value and iodine number of fats

Recommended Books

Biochemistry by Lehninger
Outlines of Biochemistry by Cohn and Stumph
Biochemistry of Nucleic acids by Davidson
Biological Chemistry by Mullar and Cards
Biochemistry by White, Handler and Smith
Methods in Enzymology series
The Cell – Bratch amd Mirsky series
Biochemistry lab manual by Jayaraman

M.Sc. (Previous) Microbiology II Semester (CBCS)
Paper I MB 201 Microbial Physiology and Metabolism (Theory) **(CBCS)**
(4 units x 15 hrs = 60 hrs teaching)

Unit I

Microbial nutrition – Elemental nutrient requirements of microbes, nutritional groups of bacteria. The autotrophy – Photoautotrophy and bacterial photosynthesis
Chemoautotrophy and autotrophic metabolism.
Concept of heterotrophy – Photoheterotrophy and chemoheterotrophy. Heterotrophic metabolism in bacteria. .

Unit II

Microbiological media and cultivation of microorganisms - Autotrophic media, defined synthetic mineral media, heterotrophic media. The concept of prototrophs and auxotrophs, prototrophic (minimal) media (defined media), complex media (undefined media), Basal medium, enriched media, enrichment media, selective media, biochemical media differential media, maintenance media, transport media. Media for cultivation of fungi, and algae Cultivation methods of bacteria, slant culturing, stab culturing, agar plate culturing, rolled tube/bottle culturing, tube cultures, flask culturing.
Aerobic culturing methods, anaerobic culturing methods
Environmental requirements of growth.

Unit III

Microbial growth: The concept of growth and definition, formation of protoplasm, building of macromolecules from elemental nutrients, supramolecules, orgnelles of cell and cellular components. Cell cycle in microbes and generation time.
Growth phases of bacteria – Lag phase, exponential (logarithmic) phase, stationary (ideo) phase, decline and survival of microbial cells. Importance of each growth phase.
Synchronous cultures – methods of synchronous culturing, Continuous culturing methods, factors effecting growth. Methods of growth measurement. Cell - cell signaling, cross kingdom talk. Quorum sensing: compounds Acyl Homoserine lactones.

Unit IV

Nature and properties of spores: Bacterial endospore structure, phenomenon of sporulation, biochemistry and genetics of sporulation. Induction of sporulation phenomenon. Germination of spores
Respiration (Aerobic and anaerobic) and fermentation. Glycolysis (EMP, HMP and ED) pathways. TCA Cycle and its integration.
Biological membranes structure and function Electron transport, oxidative phosphorylation and their mechanism

II Semester Paper I MB 251 Microbial Physiology and Metabolism (Practicals) **(CBCS)**

Preparation of microbiological media. Autotrophic media, minimal media, basic media, enriched media, enrichment media, differential media.
Isolation and cultivation of autotrophic microbes
Culturing methods of microbes – slant and stab cultures, tube culture, flask cultures, shake flask cultures
Anaerobic culturing methods – anaerobic jar and its use, pyrogallol method, thioglycollate media culturing, anaerobic glove box and its application
Microbial growth experiments – Viable count of growing cultures and generation time determination
Determination of microbial growth by turbidometric methods
Study of bacterial growth curve
Factures effecting the microbial growth
Methods studying microbial respiration

Recommended Books

Text book of Microbiology by M. Burrows; General Microbiology by Stainier, Deudroff and Adelberg;
Review of medical microbiology by Jawitz, melnick and Adelberg; Bacterial and Mycotic infections of man. Ed. Dubos and Hirst Lipincott; Principles of Microbiology and Immunology by Davis, Dulbecco , Eison, Ginsberg and Wood.; Text book of Microbiology by Ananthanarayanan; Microbiology by Pelczar M.J., Ried, RD and Chan, ECS.
Microbial Physiology by Moat, ; Brock's Biology of microorganisms by Madigan, MT et al
Biochemistry of bacterial growth by Mandelstum, Mc Quillon and Dawes; Bacterial Metabolism by Dwellely
Photosynthesis by Dewlin and Barker; Laboratory Experiments in Microbiology by Gopal Reddy et al
Microbes in Action by Seoley HW and Van-Demark, PJ
Biochemistry by Lehninger
Outlines of Biochemistry by Cohn and Stumph
Biochemistry of Nucleic acids by Davidson
Biological Chemistry by Mullar and Cards
Biochemistry by White, Handler and Smith
Methods in Enzymology series
The Cell – Bratch amd Mirsky series
Laboratory experiments in Microbiology by Gopal Reddy et al
Biochemistry lab manual by Jayaraman

M.Sc. (Previous) Microbiology II Semester (CBCS)
Paper II MB 202 Food Microbiology and Toxicology (Theory) **(CBCS)**
(4 units x 15 hrs = 60 hrs teaching)

Unit I

Introduction to fermented foods, Microbial products of milk.
Microbiology of cheese, butter, yogurt, Microbiology of bread, sauerkraut, idly
Bacteriological examination of fresh and canned foods
Spoilage of foods and factors governing the spoilage
Food preservation methods.

Unit II

Dairy Microbiology - Types of microorganisms in milk, significance of microorganisms in milk, microbiological examination of milk, control of microbial flora of milk
Microbes and animal interactions – Rumen Microbiology
Termite microbial communities, Silage.

Unit III

Probiotics, Prebiotics and their significance in human beings and animals, Genetically Modified Probiotics, Prebiotics and the Infant Microbiota.
Microbial Food poisoning, Bacterial toxins: Types of toxins, exotoxins, endotoxins and enterotoxins- mechanism of action, Toxoids.

Unit IV

Mycotoxins: Groups of mycotoxins, effects on human and animal health, Detoxification methods(Physical, Chemical and biological). Mechanism of toxicity, Microbial threats and Bioterrorism, Test procedures to detect disturbances of microbial communities. Current and future implications concerning food safety, hazards and risks.

II Semester Paper I MB 251 Food Microbiology and Toxicology(Practicals) **CBCS)**

Microbiological examination of fresh and canned foods and mushrooms
Microbiological examination of spoiled foods and fruits
Microbiological examination of milk and milk products
Microbiological quality testing of milk (MBRT test)
Isolation and cultivation of anaerobic microbes from rumen and termites
Isolation of toxin producing organisms and estimation of their toxins in different foods
Extraction of Mycotoxins from contaminated food.
Detoxification of mycotoxins.
Isolation of bacterial and fungal probiotics
Development of probiotics *in vitro*
Test procedures to detect disturbances of microbial communities

Recommended books

Food Microbiology by Frazier
Microbial Ecology – A conceptual approach by Lynch and Poole
Basic food microbiology (Abridged edition) by George J. Banwart
Laboratory experiments in microbiology by Gopal Reddy et al
Brock's Biology of Micro organisms by Madigan et al
Probiotics 3 by R. Fuller, G. Perdigon (Kluwer Academic Publishers)
Probiotics and Prebiotics: Scientific Aspects by Gerald W. Tannock *University of Otago, Dunedin, New Zealand (*Caister Academic Press*)*
Biotoxicology by Kamal narayan and Vohra.

M.Sc. (Previous) Microbiology II Semester (CBCS)
Paper III MB 203 Immunology (Theory) **(CBCS)**
(4 units x 15 hrs = 60 hrs teaching)

Unit I

History of immunology. Hematopoiesis, Cell lineage, components of immune system, cells and organs of immune system.
Antigens –Nature, properties and types. Haptens
Antibody -Structure , functions and classification. Isotypes, allotypes and idiotypes.
Immunoglobulin genes. Generation of antibody diversity. Clonal nature of the immune response - clonal selection theory. T cell and B cell receptors.

Unit II

Overview of Innate and adaptive immunity.
T cell B cell interactions.
Immunological tolerance-central and peripheral
Major Histocompatibility Complex (MHC). Human leucocyte antigen (HLA) restriction
Processing and presentation of antigen by MHC. Transplantation immunity, Auto immunity.
Inflammation, Hypersensitivity - immediate and delayed type hypersensitivity reactions.

Unit III

Antigen and antibody reactions–Agglutination, Precipitation, neutralization ,Complement fixation, classic and alternative pathways and function. Labeled antigen-antibody reactions- ELISA, RIA, immune blot, immunoflourescence ,cell sorting-flow cytometry.
Development Of immuno diagnostic kits.
Types of vaccines and principles of Immunization.

UNIT -IV

Hybridoma techniques and monoclonal antibody production - Myeloma cell lines, fusion of myeloma cells with antibody producing B-cells, fusion methods. Selection and screening methods for positive hybrids, cloning methods. Production, purification and characterization of monoclonal antibodies. Applications of monoclonals in biomedical research, clinical diagnosis and treatment.
Tumor immunology. Immuno diagnosis and immune therapy of cancer

Agglutination reactions – Widal, VDRL, HA, Blood typing – tube method
Precipitation test: Ring interphase, single radial diffusion, Ouchterlony, immunoelectrophoresis
Neutralization test – Plaque neutralization, HAI, Haeme adsorption test
Seperation of serum, WBC, RBC, Plasma, CBP and differential blood picture.
Seperation of serum proteins
Blot transfer and detection of protein on blot by staining
ELISA
Indirect agglutination (a) Hepatitis (b) Pregnancy hCG Ag

Recommended Books

Immunology and immunopathology by Stewart Sell
Cellular and molecular immunology by Abul K. Abbas et al
Immunology by Herman N. Eosen
Test book of Immunology by Barret
Molecular basis of immunology by Constantin Bena
Immunology – The science of self-non self discrimination by Jan Klein
Essential Immunology by Roitt, IM
Immunology by Kuby, J.

M.Sc. (Previous) Microbiology II Semester (CBCS)
Paper IV MB 204 Pharmaceutical Microbiology (Theory) **(CBCS)**
(4 units x 15 hrs = 60 hrs teaching)

Unit I

The ecology of microorganisms affecting pharmaceutical industry – The atmosphere, water, skin & respiratory flora of personnel, raw-materials, packing, equipments, building, utensils etc. Types of microorganisms occurring in pharmaceutical products.

Microbiological spoilage prevention of pharmaceutical products – Microbial spoilage, preservation of pharmaceutical products; antimicrobial agents used as preservatives, evaluation of the microbial stability of formulation

The sterilization in pharmaceutical industry and sterile pharmaceuticals – Heat, radiation, gaseous and filtration sterilization, injectable, sterile fluids

Sterilization control and sterility testing – Sterilization indicators, automation, sterility testing methods. Good manufacturing practices and hygiene in industry and hospital

Unit II

Non-Medicinal antimicrobial agents – Bacteriostatic and bactericidal agents, factors affecting antimicrobial activity. Non medicinal antimicrobial chemicals - sanitizers, disinfectants, antiseptics, antimicrobial action of phenols and phenolic compounds, alcohols, halogens, heavy metals, dyes, aldehydes, detergents.

Medicinal antimicrobial agents: History of chemotherapy – plants and arsenicals as therapeutics, Paul Ehrlich and his contributions, selective toxicity and target sites of drug action in microbes. Development of synthetic drugs – Sulphanamides, antitubercular compounds, nitrofurons, nalidixic acid, metronidazole group of drugs.

Antibiotics - The origin, development and definition of antibiotics as drugs, types of antibiotics and their classification. Non-medical uses of antibiotics

Unit III

Principles of chemotherapy – Clinical and lab diagnosis, sensitivity testing, choice of drug, dosage, route of administration, combined/mixed multi drug therapy, control of antibiotic/drug usage

Mode of action of important drugs – Cell wall inhibitors (Betalactam – eg. Penicillin), membrane inhibitors (polymyxins), macromolecular synthesis inhibitors (streptomycin), folic acid inhibitor (sulfa drug) and antifungal antibiotics (nystatin)

Unit IV

The drug resistance – The phenomenon, clinical basis of drug resistance, biochemistry of drug resistance, genetics of drug resistance in bacteria.

Microbiological assays: Assays for growth promoting substances, nutritional mutants and their importance, vitamin assay, amino acid assay

Assay for growth inhibiting substances – Assay for non-medicinal antimicrobials (Phenol coefficient/RWC). Drug sensitivity testing methods and their importance. Assay for antibiotics – Determination of MIC, the liquid tube assay, solid agar tube assay, agar plate assay (disc diffusion, agar well and cylinders cup method).

Introduction to pharmacokinetics.

M.Sc. (Final) II Semester (CBCS)
Paper II MB 252 Pharmaceutical Microbiology (Practicals) **(CBCS)**

Sterility testing methods for pharmaceutical products
Testing for sterilization equipment
Tests for disinfectants (Phenol coefficient/RWC)
Determination of antibacterial spectrum of drugs/antibiotics
Chemical assays for antimicrobial drugs
Testing for antibiotic/drug sensitivity/resistance
Determination of MIC valued for antimicrobial chemicals
Microbiological assays for vitamins/amino acids
Microbiological assays for antibiotics (Liquid tube assay, agar tube assay, agar plate assays)
Toxicity tests in lab animals; Pyrogenicity tests in lab animals

Reference/Recommended Books for MB 403 Pharmaceutical Microbiology

Disinfection, sterilization and preservation. Block, S.S. (ed). Lea and Febigor, Baltimore
Pharmaceutical Microbiology. Huge, W.B. and Russel, AD.Blackwell Scientific, Oxford
Principles and methods of sterilization in health sciences. Perkins, JK. Pub: Charles C. Thomos, Springfield.
Compendium of methods for the microbiological examination of foods. Vanderzant, C. and Splittstoesser, D. Pub: American Public Health Association, Washington, D.C.
Disinfectants: Their use and evaluation of effectiveness. Collins, CH., Allwood, MC., Bloomfield, SF. And Fox, A. (eds). Pub: Academic Press, New York
Inhibition and destruction of microbial cell by Hugo, WB. (ed). Pub: Academic Press,NY
Manual of Clinical Microbiology. Lennette, EH. (ed).Pub: American Society for Microbiology, Washington.
Principles and Practices of disinfection. Russell, AP.,Hugo,WB., and Ayliffe, GAJ.(eds). Publ. Blackwell Sci.
Biochemistry of antimicrobial action. Franklin,DJ. and Snow, GA.Pub:Chapman & Hall.
Antibiotics and Chemotherapy. Garrod, L.P., Lambert, HP. And C'Grady, F. (eds). Publ: Churchill Livingstone.
Antibiotics. Lancini, G. and Parenti, F. publ: Springer-Verlag.
The Molecular Basis of antibiotic action. Gale, EF. Et al. Publ: Wiley, New York.
Antimicrobial Drug action. Williams, RAD., Lambart, PA. & Singleton, P. Pub:Bios Sci.
Microbiological Assays. Hewitt.
Antiviral Drugs. Kargor, S.
Burger's Medicinal chemistry Vol. I – III. Ed. Nanfield E. World.
The control of antibiotic resistant bacteria. Stuart, Harris and Harris.
Indian Pharmacopea; United States Pharmacopea; British Pharmacopea.

M.Sc. (Final) Microbiology III Semester (CBCS)
Paper I MB 301 Molecular Biology and Microbial Genetics (Theory) (CBCS)

(4 units x 15 hrs = 60 hrs teaching)

Unit I

Detailed structure of DNA , Z-DNA, A & B DNA, Denaturation and melting curves. Genome organization in prokaryotes and eukaryotes, Enzymes involved in DNA replication, Modes of DNA replication- Detailed mechanism of Semiconservative replication .

Plasmids: nature, classification, properties and replication.

Eukaryotic telomere and its replication.

Unit II

Prokaryotic and eukaryotic transcription. Structure and processing of m-RNA, r-RNA t-RNA. Ribozyme, Genetic code and Wobble hypothesis, Translation in Prokaryotes and eukaryotes, Post translational modifications, Gene regulation and expression – Lac operon, arabinose and tryptophane operons, Gene regulation in eukaryotic systems, repetitive DNA, gene rearrangement, promoters, enhancer elements.

Unit III

Types of mutagens, molecular basis of mutations, analysis of mutations, site directed mutagenesis and reverse genetics. Detailed mutagenesis and repair mechanism of UV, Ethidium Bromide and Nitrus oxide. DNA damage and repair mechanisms. Isolation and applications of mutants. Transposable elements – Definition, detection of transposition in bacteria, types of bacterial transposons and applications of transposons.

Unit IV

Bacterial Recombinations-Discovery, gene transfer, molecular mechanism, detection , efficiency calculation and applications. Bacterial transformation- Competency and resistance.

Bacterial conjugation – Sex factor in bacteria, F and HFR transfer, linkage mapping .

Bacterial transduction – transduction phenomenon, methods of transduction, co-transduction, generalized, specialized and abortive transduction, sex-ductions.

Paper I MB 351. Molecular Biology and Microbial Genetics- Practicals (CBCS)

Isolation of genomic DNA from E.coli and Yeast.

Estimation of DNA, RNA and Protein (colourimetry)

Determination of molecular weight of DNA, resolved on agarose gel electrophoresis

Induction of enzymes – Lac operon

Determination of molecular weight of protein by PAGE

Induction of mutations by physical/chemical mutagens, screening and isolation of mutants, Replica plating technique

Transformation in bacteria

Conjugation in bacteria

Protoplast preparation, Fusion and regeneration

Recommended books

Molecular biology by Robert Weiver

Molbio By Upadyaya

Molecular biology by David and Freifelder

Microbial genetics by David and Freifelder

Genetics of bacteria and their viruses by William Hayes

Molecular biology of thee gene by Watson et al

The Lehninger Biochemistry

Molecular biotechnology by Primerose

Molecular Biotechnology by Bernard R. Glick and Jack J Pasternak

Molecular Genetics of Bacteria by Larry Snyder and Wendy Champness

M.Sc. (Final) III Semester Microbiology (CBCS)
Paper II MB 302 Industrial Microbiology (Theory) **(CBCS)**
(4 units x 15 hrs = 60 hrs teaching)

Unit I

Introduction to industrial microbiology. Definition, scope, history, microorganisms, properties and industrial products

Screening for microbes of industrial importance. Primary screening, screening for amylase, organic acid, antibiotic, amino acid and vitamin producing microorganisms. Secondary screening. Further evaluation of primary isolates

Detection and assay of fermentation products. Physico-chemical methods and biological assays. Fermentation equipment and its use. Design of fermenter, type of fermenter, agitation, aeration, antifoam, pH and temperature control.

Unit II

Inoculum media, inoculum preparation

Raw materials Saccharides, starchy and cellulosic materials

Fermentation media and sterilization.

Types of fermentations processes – Solid state, surface and submerged fermentations

Unit III

Batch, fed batch and continuous fermentations. Direct, dual or multiple fermentations. Scale-up of fermentations. Product recovery methods.

Fermentation type reactions, alcoholic, lactic acid, mixed acid, propionic acid, butandiol and acetone-butanol types.

Unit IV

Strain development strategies. Environmental factors and genetic factors for improvement. Immobilization methods – Absorption, covalent linkage, entrapment and cross linkage, types of carriers, advantage and disadvantages.

III Semester Paper I MB 351 Industrial Microbiology (Practicals) **(CBCS)**

Screening for amylase producing organisms
Screening for organic acid producing microorganisms
Isolation of antibiotic producing microorganisms by crowded plate technique
Isolation and culturing of yeasts
Separation of amino acids by chromatography
Estimation of glucose by DNS method
Estimation of ethanol by dichromate method
Estimation of maltose
Immobilization of microbial cells by entrapment method

Recommended Books

Industrial Microbiology by Casida, LE
Industrial Microbiology by Patel, AH
Industrial Microbiology by Miller, BM and Litsky
Industrial Microbiology by Prescot and Dunn
Microbial Technology by Peppler, JH and Perlman, D.
Biochemistry of Industrial Microorganisms, by Rainbow and Rose
Economic Microbiology by Rose Vol I – V
Microbial Enzymes and Biotechnology by Fogarty WM and Kelly, CT
Comprehensive Biotechnology, All volumes Ed. Murray Moo-Yong
Biotechnology (A text book of industrial Microbiology) Ed. Cruger & Cruger
Advances in Applied Microbiology Ed. Perlman Series of volumes

M.Sc. (Final) Microbiology III Semester (CBCS)
Paper III MB 303 Environmental and Agriculture Microbiology (Theory) **(CBCS)**
(4 units x 15 hrs = 60 hrs teaching)

Unit I

Microorganisms in air and their importance (brief account)
Microorganisms and water pollution
Water-borne pathogenic microorganisms and their transmission.
Sanitary quality of water. Water pollution due to degradation of organic matter
Aerobic sewage treatment – Oxidation ponds, trickling filters, activated sludge treatment
Anaerobic sewage treatment – Septic tank

Unit II

Recalcitrant molecules,
Bioremediation technologies: *in situ* and solid phase; *ex situ* and bioreactors
Microbial remediation of metals, Molecular techniques in bioremediation
Methods of enumeration and activity of microbes in environment
Microbial biodegradation of organic pollutants.

Unit III

Degradation of carbonaceous materials in soil – cellulose, hemicellulose and lignin decomposition, factors governing the decomposition and biochemistry of decomposition, Soil humus formation, Nitrification –Microbes involved, factors influencing nitrification, nitrifying bacteria and biochemical mechanism. Denitrification – microbes involved, factors influencing and the mechanism of denitrification and nitrate pollution

Unit IV

Nitrogen fixation – Asymbiotic and symbiotic nitrogen fixation, microorganisms involved, biochemistry and genetics of nitrogen fixation, measurement of nitrogen fixation, ecological and economic importance of nitrogen fixation. Biofertilizers – bacterial fertilizers and production of rhizobial inoculants and blue-green algae, quality control tests, Microbes and plant interactions – Rhizosphere, Phyllosphere and Mycorrhizae.

Paper II MB 352 Environmental and Agricultural Microbiology (Practicals) -CBCS

Isolation and observation of air microflora
Enumeration of soil microorganisms (bacteria, actinomycetes, fungi) by standard plate count
Estimation of soil microbial activity by CO2 evolution
Isolation of cellulose decomposing microbes and estimation of cellulose activity
Estimation of ammonifiers, nitrifiers and denitrifiers in soil by MPN METHOD
Isolation and culturing of Rhizobium sp from root nodules and Azospirillum from grasses (Cyanodon)
Biological enrichment isolation of Rhizobium from soil by Leonard Jar experiment
Nodulation testing by tube/jar method
Observation and assessment of soil algae/algal biofertilizers
Estimation of N2 fixation (Micro Kjedhasl method/GC method)
Estimation of BOD
Testing for microbial sanitary quality of water (coliform test)
Bioremediation-*in-situ,* solid phase and bioreactors
Isolation and observation for phyllosphere microflora
Isolation and observation for rhizosphere microflora
Observation for Mycorrhizae
Effect of pesticides on microbial activity

Recommended Books

Soil Microbiology by Alexander Martin
Microbial ecology, Fundamentals and Applications Ed. Benjamin-Cummings
Environmental Biotechnology-Fundamentals and applications. By Parihar (Agrobios india –publishers)
Soil Microbiology by Singh, Purohit,Parihar published by student edition.
Soil Biotechnology by JM Iynch
Microbial Ecology: Organisms, Habitats, and Activities by Stolp, H.
Soil Microbiology and Biochemistry by Paul E. and PE Clank
Microbial Ecology: Principles, Methods and Applications by Lavin, Seidler, Rogul
Biological Nitrogen Fixation by Quispel
Soil Microorganisms and Plant Growth by N.S,. Subba Rao.
Laboratory experiments in microbiology by Gopal Reddy et al
Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom production technology by K R Aneja
Biofertilizers for sustainable Agriculture by Arun K. Sharma
Environmental Microbiology by K. Vijaya Ramesh (MJP Publishers)
Brock Biology of Micro organisms by Madigan et al
Waste water microbiology by Bitton, G.
Waste water treatment – Biological and chemical process by Henze, M.
Biodegradation and Bioremediation second edition by Martin Alexander (Academic Press 2001)
Bioremediation - Principles and Applications by Ronald L Crawford and Don L Crawford , Cambridge University Press
J.M. Helawell - Biological indicators of freshwater pollution and environmental management. Elsevier Applied Science Publishers, London. (1986). 546p
F. Mason - Biology of freshwater pollution. Third edit. Longman Group (1996). 356p
Environmental Microbiology by P D Sharma (Narosa Publishing House)

M.Sc. (Final) Microbiology III Semester (CBCS)
Paper IV MB 304 Medical Bacteriology (Theory) **(CBCS)**
(4 units x 15 hrs = 60 hrs teaching)

Unit I

Principles of Medical Microbiology:
Classification of medically important microorganisms. Normal flora of human body – Origin of normal flora, factors that influences normal flora, role of the resident flora, effect of antimicrobial agents on normal flora, characteristics of normal flora
Distribution and occurrence of normal flora (Skin, conjunctiva, nose, nasopharynx, sinuses, mouth, upper respiratory tract, intestinal tract, urogenital tract)
Bacteria in the blood and tissues.

Unit II

Properties of pathogenic microorganisms. Factors that influence pathogenicity
Type of infections, source of infections, different modes/means of infections
Diagnostic microbiology – Types of specimen, specimen collection, transportation of specimen, processing, laboratory investigations, specific lab. Tests, non-specific lab tests, diagnosis and report. Use of lab animals in diagnostic microbiology.

Unit III

Systematic bacteriology – Detailed study of morphology, cultural characteristics, antigenic structure, pathogenesis, diagnostic lab tests (conventional and molecular), epidemiology, prevention and treatment of the following bacterial pathogens.
Bacterial air borne infections – B-Haemolytic streptococco, Pneumococci, *Corynebacteium diphtheriae, Mycobacterium tuberculosis, Mycobactterium leprae, Neisseria meningitides, haemophilus influenzae.*
Sexually transmitted diseases caused by bacteria, *Treponima pallidum, Neisseria gonorrhea.*

Unit IV

Systematic bacteriology – Detailed study of morphology, cultural characteristics, antigenic structure, pathogenesis, diagnostic lab tests (conventional and molecular), epidemiology, prevention and treatment of the following pathogenic bacteria:
Water borne infections – *E.coli, Salmonella typhi, Shigella dysenteriae, Vibrio choleraae.* Wound infections – *Staphylococcus aureus, Clostridium tetani, Clostridium welchi, Pseudomonas.*

Paper II MB 352 Medical Bacteriology (Practicals)

Preparation of different types of culture media/observation. Blood Agar, Chacolate Agar, Mannitol salt agar, Blair Parker medium, MacConkey agar, Lowensten-Jension medium, Wilson Blair Bismuth sulphite medium, Biochemical media.
Staining techniques – Gram's staining, AFB staining, Albert Staining, Capsular staining
Isolation and identification of various pathogenic bacteria by microscopic, macroscopic, biochemical, enzymatic and serological tests (Coagulase ,catalase,WIDAL,VDRL tests.)
Examination of pathogenic bacteria /permanent slides.
Bacteriological examination of urine, pus, throat swab etc from patients for diagnosis.
PCR based diagnosis.

Recommended Books

Review of Medical Microbiology by Jawitz, Melnick and Adelberg
Diagnostic Microbiology by Bailey and Scott
Medical Microbiology by Cruckshanak et al Vol I & II
Text book of Microbiology by Ananthanarayanan and jayaram Paniker

M.Sc. (Final) Microbiology IV Semester (CBCS)
Paper I MB 401 Cell and Molecular Biotechnology (Theory) **(CBCS)**
(4 units x 15 hrs = 60 hrs teaching)

Unit I

a. Cell cycle: Cell division regulation and cancer. Role of protein Kinases in cell cycle. Programmed cell death.Geno toxicity assays.

b. Signal transduction : G- Protein linked receptors. Concept of second messenger, cAMP & cGMP. Steroid/peptide hormone regulation, tissue specific regulation.
Protein folding and the roles of Molecular chaperones.

Unit II

Vectors in Molecular Biology, Artificial chromosomes, Enzymes, Polymerase chain reaction, DNA/Protein sequencing , rRNA/ Genomic/ c DNA Library construction and screening.
Cloning Techniques: cloning in *E-coli*, Cloning in *Bacillus subtilis*, Cloning in Yeast promoters, Vectors, cloning strategy, Transformation, Selection, Expression and detection of cloned genes. Hela genomes.

Unit III

Production of recombinant antibodies, Protein-protein and protein-DNA interactions, Biochips (DNA chips and Protein chips), Pharmacogenomics, Molecular diagnostics, RFLP DNA markers: rRNA, Molecular hybridization, RAPD, AP-PCR, DAF AFLP and analysis Simple sequence repeat markers, DNA fingerprinting, Gene knock out – RNAi and Gene silencing, Gene therapy, ~~Metagenomics.~~

Unit IV

Bioinformatics -Databases, Primer Design, Sequence analysis: Gene finding, motif finding and multiple sequence alignment. Protein structure analysis-Modeling.
Protein engineering and drugs design: Rational of protein engineering, steps involved in protein engineering and drug design.

Isolation of Plasmid DNA,RNA and Proteins from E.coli.
Restriction mapping
PCR technique.
Preparation of competent cells and transformation
Gene cloning in bacteria (Demonstration).
Recombinant confirmation (Gel shift assays, blue white selection).
Southern transfer – demonstration
Demonstration of RFLP/AFLP
Separations of Proteins by Column chromatography
Primer Design
Protein Modeling

Recommended Books

Molecular biology by Robert Weiver
Molecular biology by David and Freifelder
Microbial genetics by David and Freifelder
Molecular biotechnology by Chanarayppa
Methods in Molecular Cloning by Sambrook.
Genetics of bacteria and their viruses by William Hayes
Molecular biology of the gene by Watson et al
The Biochemistry of nucleic acids by Davidson JN
Molecular biotechnology by Primerose
Molecular Biotechnology by Bernard R. Glick and Jack J Pasternak
DNA Microarrays Ed. M. Schena

M.Sc. (Final) IV Semester Microbiology (CBCS)
Paper II MB 402 Microbial Biotechnology (Theory) **(CBCS)**
(4 units x 15 hrs = 60 hrs teaching)

Unit I

Fermentative production of industrial alcohol, uses, raw materials, microorganisms, inoculum preparation, preparation of wort, fermentation and recovery.
Fermentative production of beer – Medium components, malt, malt adjuncts, hops, water. Preparation of wort, mashing, wort boiling, microorganism, inoculum preparation, fermentation, cold storage maturation, carbonation, packing and preservation.
Principles of wine making – Fruit selection, picking, crushing, sulphite addition, processing, fermentation, aging and bottling.

Unit II

Fermentative production of citric acid, uses, microorganism, inoculum preparation, medium preparation, fermentation, recovery and mechanism of citric acid production.
Fermentative production of vitamin B12 – Uses, structure of vit-B12, microorganisms, inoculum preparation, medium preparation, fermentation and recovery.
Fermentative production of glutamic acid – Uses, microorganism, inoculum preparation, production medium, fermentation and down stream processing.

Unit III

Antibiotics – Commercial production of benzyl penicillin, uses, microorganism, inoculum preparation, production medium, fermentation, recovery and semi-synthetic penicillins.
Fermentative production of tetracyclines – uses, chlortetracycline, oxy-tetracycline, tetracycline and semisynthetic tetracyclines, structures, microorganisms, inoculum preparation, production medium, fermentation and recovery methods.

Unit IV

Production and application of microbial enzymes. – Amylases and proteases, uses, microorganisms, inoculum preparation, production medium, fermentation and recovery
Steroid transformations – Substrates, typical structures, microorganisms, inoculum preparation, 11-hydroxylation, process and recovery.
Principles of vaccine production and types of vaccines
Microbial biopesticides
Microbial products from genetically modified (cloned) organisms eg. Insulin.

IV Semester Paper I MB 451 Microbial Biotechnology (Practicals) (CBCS)

Production of ethanol by flask fermentation, recovery of ethanol by distillation and calculation of fermentation efficiency
Preparation of wine from grapes/fruits by fermentation
Production of citric acid by fungal fermentation, recovery and estimation
Production of amino acid (Glutamic acid/lysine) by fermentation
Production of amylase by fermentation, recovery and estimation
Production and estimation of penicillin by flask fermentation
Immobilized bacteria/yeast/enzyme in fermentation
Scale up of fermentation.

Recommended Books

Industrial Microbiology by Casida, LE
Industrial Microbiology by Patel, AH
Industrial Microbiology by Miller, BM and Litsky
Industrial Microbiology by Prescot and Dunn
Microbial Technology by Peppler, JH and Perlman, D.
Biochemistry of Industrial Microorganisms, by Rainbow and Rose
Economic Microbiology by Rose Vol I – V
Microbial Enzymes and Biotechnology by Fogarty WM and Kelly, CT
Comprehensive Biotechnology, All volumes Ed. Murray Moo-Yong
Biotechnology (A text book of industrial Microbiology) Ed. Cruger & Cruger
Advances in Applied Microbiology Ed. Perlman Series of volumes

M.Sc. (Final) IV Semester Microbiology (CBCS)
Paper III MB 403 Medical Virology and Parasitology (Theory)-CBCS
(4 units x 15 hrs = 60 hrs teaching)

Unit I

Diagnostic virology – Cultivation of pathogenic viruses in lab animals and tissue culture
Identification of pathogenic viruses and establishment of viral etiology
Structure, cultivation, pathogenicity, lab diagnostics, prevention and control of air borne viral infections – Influenza virus, Rhinovirus, Corona virus, Rubella virus, Adeno virus (type 2), Mumps virus and Measles virus.

Unit II

Structure, cultivation, pathogenicity, lab diagnostics, prevention and control of viruses transmitted by water - Hepatitis (HAV), Polio myelitis
Structure, cultivation, pathogenicity, lab diagnostics, prevention and control of viruses transmitted by Zoonosis – Rabies, Japanese encephalitis

Unit III

Structure, cultivation, pathogenicity, lab diagnostics, prevention and control of contact and sexually transmitted viral diseases – Small pox, Herpes (Herpes simplex virus), Hepatitis viruses and their diseases
Acquired immunodeficiency syndrome (AIDS)

Unit IV

Structure, cultivation, pathogenicity, lab diagnostics, prevention and control of Malaria, Amoebiasis, Trichomoniasis, Helmithic infections (Round worms, Hook worms).
Medical Mycology – Dermatomycosis, Systemic mycosis.

MB 452 Medical Virology and Parasitology (Practicals)

Tissue culture techniques (demonstration)
Microscopic studies of viruses infected materials (demonstration)
Examination of pathogenic fungi
Examination of stool for Hookworm, Round worm
Examination of stool for *Entamoeba histolytica*
Examination of blood smear by Leishman stain for Malarial parasites
Immunodiagnosis - Tridot test for HIV, Hepstic test for HBV, ELISA.

Recommended Books

Review of medical microbiology by Jawitz et al
Medical laboratory Manual for tropical countries Vol I & II by Monica Cheesbrough
Text Book of Microbiology by Ananthanarayanan and Jayaram Paniker
Viral and Ricketsial infections of Man by Horsfall and Jam
Text book of Virology by Rhodes and Van Royan
Virological Procedures by Mitchal hasking
Virologoy by Wilson and Topley

M.Sc. (Final) IV Semester Microbiology (CBCS)
Choice Based Paper
Paper IV CB/MB 404/1 - Microbial Proteomics (Theory)-CBCS
(4 units x 15 hrs = 60 hrs teaching)

Unit I

Protein structure – Different levels of protein structure, Protein Folding and unfolding, Active sites and effects of pH, temperature, substrate concentrations, inhibitors and activators on activity. Protein functions,e.g. structural, storage, transport, hormonal, receptor, contractile, defensive, enzymatic. Protein interaction in cell signaling neurotransmitters and membrane channel opening and closing.

Unit II

Separation techniques – 2-D gel and polyacrylamide gel electrophoresis (PAGE)

Biological mass spectrometry -MALDI-MS , ESI-MS, LC-MS/MS Finger printing.

Protein identification – Peptide mass fingerprinting (PMF), Electro blotting and sequencing

Determination of 3-D structures by x-ray crystallography ,NMR and homology modeling.

Unit III

Microbial pathogenesis at the proteome level. Proteomics of *Saccharomyces cerevisiae*-cell wall & transport, differential expression in stress. Proteomics of probiotic lactobacilli-intestinal epithelial cells interactions, Lantibiotics and Immunomodulators. Proteomic Identification of *Mycobacterium tuberculosis*

Unit IV

Protein-Protein interaction, Protein-DNA intereactions. Yeast two hybrid system. Protein micro arrays- Protein Markers, Clinical Proteomics, Small peptides, Personalized medicine, Protein engineering, Drug design. Proteomic strategies in Cancer, Prions.

Paper IV CB/MB 404/2 – Microbial Ecology and Plant microbe interactions (Theory)-CBCS
(4 units x 15 hrs = 60 hrs teaching)

Unit I
PGPM-Plant growth promoting microorganisms: Beneficial, symbiotic- establishment of symbiotic relations (mycorrhiza, rhizobium), asymbiotic, epiphytic, endophytic microbes. plant-microbe beneficial interactions. Mechanisms of plant growth promotion. Microbial inoculants and their detection methods in soil.

Unit II
Plant Pathology and pests: Nature and classification of plant pathogenic fungi, diseases caused by fungi: *Sclerotium rolfsii* and *Macrophomina phaseolina* (collar rot disease, charcoal rot) and bacteria: *Xanthomonas* (black rot), actinomycetes: Streptomyces (soft rot) their control measures. Infections caused by pest: Helicoverpa and Spodoptera Mechanisms of disease control: Production of antibiotics and lytic enzymes, mechanism(s) of pathogenesis and resistance

Unit-III
Molecular plant microbe-interactions: Cell signalling, Quorum sensing, Planktonic growth and Biofilm formation. Invasion of plant tissue:- resistance mechanisms against attack by plant pathogens (fungi and nematodes); induced resistance; systemic acquired resistance, non-host resistance. Role of biotic and abiotic factors in microbial interactions. Molecular detection of pathogens.

Unit-IV
Microbial Biofertilizers example: Rhizobium, Azospirillum, Pseudomonas, Bacillus, Trichoderma, VAM,: Production, quality control and drawbacks
Bio pesticides: Bacteria: Pseudomonas, Bacillus, Bt Fungi: Trichoderma Virus: NPV Production, quality control, registrations and drawbacks.Vermicomposting.

M.Sc. (Final) IV Semester Microbiology (CBCS)
Paper II CB/MB 452- Applied Microbiology- Practicals - CBCS

Protein isolation from E coli, Bacillus and Yeast.
Effect of pH, temperature, substrate concentrations, inhibitors and activators on Trypsin activity.
Sequence analysis of proteins (by BLAST, ClustalW and Phylip).
Protein structure prediction by Homology modeling.
Confirmation of Protein-Protein and Protein-DNA interactions by electrophoresis.

Isolation of plant beneficial bacteria from soil and vermicompost
N fixers, P-solubilizers, Siderophore producers
Isolation of Plant growth hormone producing bacteria
IAA, GA and their quantification
Isolation of plant pathogenic bacteria, fungi:
Xanthomonas, S. rolfsi, M. phaseolina, Fusarium etc. in speficic media
Isolation of antagonistic microbes:
Pseudomonas, Bacillus, Trichoderma and streptomyces
Detection of QS compounds in Bacteria.

Reference Books

Principles of Protein structure, Schultz, G. E., and Schirmer, R. H. Dr. ShaktiSahi
Proteomics, Daniel C. Leibler
Microbial Proteomic, Marjo Poutanen
Proteins: Structures and Molecular Principles (2d ed.), TE Creighton
Organic spectroscopy, William Kemp
Proteome Research: Two-Dimensional Gel Electrophoresis and DetectionMethods (Principles andPractice), T. Rabilloud (Editor), 2000, Springer Verlag
Introduction to Protein Architecture: The Structural Biology of Proteins, M.Lesk, 2001, Oxford University Pres
PGPR: biocontrol and biofertilization by Zaki A. Siddiqui
Plant-bacteria interactions: strategies and techniques to promote plant growth by Iqbal Ahmad, John Pichtel, S. Hayat
Plant Growth and Health Promoting Bacteria by Dinesh K. Maheshwari
Microbes For Sustainable Agriculture by K.V.B.R. Tilak, K.K. Pal, Rinku Dey
Biochemical and genetic mechanisms used by plant growth-promoting bacteria by Bernard R. Glick
Plant-microbe interactions, Volume 1 by Gary Stacey and Noel T. Keen
Biological control of crop diseases Volume 89 of Books in soils, plants, and the environment by S. S. Gnanamanickam
Plant-microbe interactions and biological control Volume 63 of Books in soils, plants, and the environment by Greg J. Boland, L. David Kuykendall
New Perspectives and Approaches in Plant Growth-Promoting Rhizobacteria Reseaarch by Philippe Lemanceau, Peter Bakker & Jos Raajimakers

Model Question Paper (Theory)

Palamuru University

Faculty of Science

M.Sc. (CBCS) **I/II/III/IV Semester Examination Nov./Dec. 2013**

(Effective from the batch of students admitted in I year in 2013-14)

Subject: MICROBIOLOGY

Paper: I/II/III/IV: (Title)

Time: 3 Hrs Max. Marks: 80

Part – A (Short Answer type)

(TWO questions are to be set from each unit)

Answer ALL questions

Each question carries 4 marks 8 x 4 = 32 Marks

1.
2.
3.
4.
5.
6.
7.
8.

Part – B (Essay Answer Type)

(TWO questions are to be set from each unit)

Answer any FOUR questions

Each question carries 12 marks 4 x 12 = 48 Marks

9. a) or b) } to be set from Unit I

10. a) or b) } to be set from Unit II

11. a) or b) } to be set from Unit III

12. a) or b) } to be set from Unit IV

Model Question Paper (Practical)

M.Sc. (CBCS) **I/II/III/IV** Semester Practical Exam Nov/Dec

(Effective from the batch of students admitted in I year)

Subject: MICROBIOLOGY

Paper : I/I (Title)

Time : 4 Hrs

Max. Marks:100

1. Major Experiment 1	20 Marks
2. Major Experiment 2	20 Marks
3. Minor Experiment 1	10 Marks
4. Minor Experiment 2	10 Marks
5. Spottings	20 Marks
6. Record	10 Marks
7. Viva Voce	10 Marks