ADITYA DEGREE & PG COLLEGES (A)
Autonomous and NAAC Accredited with A++ Grade (3.66/4 CGPA)
KAKINADA
Dept. of Microbiology
M.Sc., Microbiology

Course Structure

Code	Title of the paper	Total Marks	Credits	Hours per week
SEMESTER I				
MB101	General Microbiology	100(75+25)	4	4
MB102	Bacteriology and Virology	100(75+25)	4	4
MB103	Biomolecules	100(75+25)	4	4
MB104	Analytical Techniques	100(75+25)	4	4
	Lab Course			
MB101	General Microbiology	50(38+12)	2	3
MB102	Bacteriology and Virology	50(38+12)	2	3
MB103	Biomolecules	50(38+12)	2	3
MB104	Analytical Techniques	50(38+12)	2	3
SEMESTER II				
MB201	Microbial Physiology and Metabolism	100(75+25)	4	4
MB202	Cell Biology and Enzymology	100(75+25)	4	4
MB203	Molecular and Microbial Genetics	100(75+25)	4	4
MB204	Immunology	100(75+25)	4	4
	Lab course			
MB201	Microbial Physiology and Metabolism	50(38+12)	2	3
MB202	Cell Biology and Enzymology	50(38+12)	2	3
MB203	Molecular and Microbial Genetics	50(38+12)	2	3
MB204	Immunology	50(38+12)	2	3

ADITYA DEGREE & PG COLLEGES (A)
KAKINADA
Dept. of Microbiology
M.Sc., Microbiology
I SEMESTER
GENERAL MICROBIOLOGY

Hours/Week: 4 **Credits: 4**

Learning objectives:

The student will be able to learn the diversity and classification of living organisms and understand their chemical, cytological, evolutionary and genetic principles.

Learning Outcomes

1. Comprehensive understanding of the numerous developments in basic and applied microbiology
2. Highlighting the advancements and discoveries made in the field of microbiology
3. Understanding the different identification techniques. Microorganism isolation, sterilization, and culture
4. Understanding of basic cellular organisation, morphology, Classification, Pathogenesis and economic importance of various groups of microorganisms
5. Knowledge of how to examine microbial diversity through methodical methods

Course Outcomes:

1, Learning about Important Microbiological Findings and Contribution
2. Gaining knowledge about microbial preservation and sterilizing methods.
3. Understanding the general characteristics of cellular organization in prokaryotes and eukaryotes.
4. Using the microorganisms that are commercially significant.
5. Knowing the properties of growth media and how to measure them.

Unit I:

Discovery, Evolution and development of Microbiology; Contributions of Van Leeuwenhock, Joseph Lister, Pasteur, Koch, Jenner, Winogradsky, Beijerinck; Identification, characterization and classification of microorganisms; Bergy's manual, Hackel's three kingdom concept, Whittaker's five kingdom concept, three domain concept of Carl Woese;Major characteristics used in Taxonomy; the kingdoms of organisms and phylogenetic trees -Distinguishing characteristics between prokaryotic and eukaryotic cells; Structure and function of cell organelles of microorganisms.

Unit II:

Methods of sterilization- Physical methods, chemical methods and their application; Microbial cultures- pure culture isolation, Enrichment culturing techniques, single cell isolation, and pure culture development; Chemical structure of peptidoglycan, protoplasts, spheroplasts, microsomes and ribosomal RNAs, Microscopic identification characteristics, staining methods; Growth media and types; Preservation and maintenance of Microbial cultures.

Unit III:
Ecological identification methods; Bacterial nutrition and growth kinetics - synchronous, stock, batch and continuous cultures; Growth measurement methods; Cultivation of aerobes and anaerobes; Reproduction in bacteria & spore formation; Morphology, Ultra structure and chemical composition of bacteria, actinomycetes, spirochetes, rickettsiae, mycoplasma, Chlamydiae – TRIC agents and LGV Archaebacteria.

Unit IV:
General characteristics, reproduction and economic importance of fungi; Classification, structure, composition, reproduction and other characteristics of fungal divisions; Structure, reproduction and characteristics of algal divisions, Distribution of algae; Classification of algae by Fritsch; Characteristics of blue green algae, dinoflagellates, thallus organization, products of algae and their economic importance; emphasis on Spirulina; Characteristics, morphology, reproduction, lifecycle and pathology of protozoans.

Recommended Books:

1. Bergey's Manual of Systematic Bacteriology volumes I to VI
2. Methods for General and Molecular Bacteriology by GERHARDT (Editor–in-Chief)
3. Microbiology PELCZAR, CHAN & KRIEG.
4. Brock Biology of Microorganism by MADIGAN, MARTINKO & PARKER.
5. Introduction to Microbiology by ROSS.
6. Basic Microbiology by VOLK & WHEELER.
7. Fundamental Principles of Bacteriology by SALLE.
8. Introduction to Algae by Morris, I.
9. Products and Properties of Algae by Zizac.
10. Introductory Mycology, by Alexopolus, C.J.

ADITYA DEGREE &PG COLLEGE (A)
KAKINADA
Dept. of Microbiology
M.Sc.,Microbiology
I SEMESTER
Bacteriology and Virology

Hours/Week: 4 **Credits: 4**

Learning Outcomes
LO1: Gaining knowledge about certain viral infections that affect plants and animals
LO2: Being aware of the ways that viruses spread.
LO3: Outlining the many kinds of viruses and how to avoid and control them
LO4: Understanding the significance of interferons, their induction, and their therapeutic uses
LO5: Understanding the intricate relationship between host cells and viruses

Course Outcomes
CO1: Learning about the background, general characteristics, and evolution of viruses
CO2: Characterizing various viral families using an appropriate type study
CO3: Distinguishing between animal and plant viruses and their production techniques
CO4: Understanding the connections between viruses and vectors
CO5: Gaining knowledge about vector control, vaccination control, and cleanliness

Unit I
Biology of bacteria: Staphylococcus, streptococcus, Pneumococcus, Nesseria, Corynebacterium; Bacillus, Clostridium,Proteus,Shigella, Salmonella, Vibrio, Pseudomonas,Yersinia,Haemophilus, Bordetella, Brucella, Mycobacterium, Spirochetes, Mycoplasmas, Rickettsiae and Chlamydiae.
Bacterial growth- Measuring bacterial growth- Spectrophotometric method, microscopic counting, serial dilution and viable cell count, MPN, and filtration technique,Turbidostat, Chemostat; Bacterial reproduction-fission, budding and endospore formation

Unit II:
Economic importance of bacteria: A brief account on the economic importance of bacteria in Agriculture- Nitrogen fixing organisms; ecological importance-bioremediation and biopesticides; Industrial importance- source of antibiotics, production of recombinant proteins-growth factors, hormones, vaccines etc.; Normal flora in the GIT and their advantages.
Antibacterial agents: Mode of action of antibiotics and chemotherapeutic drugs; Antibiograms; Antibiotic sensitivity assays- disc method; replica plating technique. Antibiotic resistance in bacteria- various factors that contribute to the development of resistance.

Unit III:
Concept and scope of virology: History and Discovery of Viruses, Nature, origin and evolution of viruses, New emerging and re-emerging, viruses, Nomenclature, classification and structure of viruses, recent ICTV classification of viruses infecting animals, humans, plants, bacteria, algae, fungi; Major characteristics of different virus families/genera/groups; Properties of Viruses, chemical composition of viruses; Biological properties of viruses – host range, transmission-vector, non-vector; Isolation, cultivation, assay and maintenances of viruses; Viruses culture – organ culture, primary and secondary cell cultures, suspension and monolayer cell cultures, cell strains, cell lines, embryonated eggs.

Unit IV:

Viral genome and transmission: Structure and complexity of viral genomes, Replication of viruses – replication strategies of DNA, RNA viruses and regulation of viral genome expression, Transmission of viruses – Vertical (Direct) transmission, Horizontal (Indirect) transmission Vector-arthropod, non-arthropods, virus and vector relationship; Diagnosis of viral diseases, prevention and control of viruses, vaccines and immunization, chemoprophylaxis, chemotherapy, interferon therapy.

Recommended Books:

1. Virology: Frankel-Conrat; Prentice-Hall
2. Principles of Virology S.J.Flint et al., ASM press
3. Introduction to Modern Virology: Dimmock et al., Blackwell Sci.Publ
4. Principles of Molecular Virology, A.Cann. Academic Press
5. Basic Virology, Waginer and Hewelett, Black Well Science Publ
6. Medical Virology, D.O.White and F.J.Fenner, Academic Press.
7. Plant Virology, R.Hull, Academic Pres.
8. FundementalVirology, D.M.Knipe and P.M.Howley.

ADITYA DEGREE & PG COLLEGES (A)
KAKINADA
Dept. of Microbiology
M.Sc., Microbiology
I SEMESTER
MB 103- BIOMOLECULES

Hours/Week: 4 **Credits: 4**

Learning Outcomes

LO1: Capable of acquiring theoretical understanding regarding biomolecule characterization
LO2: Comprehending the Ramachandran plot concept and how peptide bonds arise.
LO3: Learning about vitamins, their biological value, and their classification
LO4: Stressing protein isolation, characterisation, and sequencing techniques
LO5: Comprehensive understanding of cellular oxidation and mineral metabolism mechanisms

Course Outcomes

CO1: A summary of the key biomolecules, classification, including proteins, lipids, and carbohydrates
CO2: Gaining knowledge about lipid classification, chemical characteristics, and functions
CO3: Acquiring conceptual understanding of proteins and their structural groups
CO4: Understanding how steroids and sterols work
CO5: Knowing the types, composition, structure, and roles of nucleic acids

Unit I:

Carbohydrates and Lipids – Classification, chemistry, properties, and function – mono, di, oligo and polysaccharides; bacterial cell wall polysaccharides; Conjugated polysaccharides– glycoproteins and lipopolysaccharides; Lipids – classification, chemistry, properties and function – free fatty acids, triglycerides, phospholipids, glycolipids & waxes; Conjugated lipids – lipoproteins; Major steroids of biological importance – prostaglandins.

Unit II:

Amino acids and proteins – classification, structure and function; Essential amino acids & amphoteric nature of amino acids and reactions and functions of carboxyl and amino groups and side chains; Peptide structure; Ramachandran's plot; Methods for isolation and characterization of proteins; Structural levels of proteins – primary, secondary, tertiary and quaternary, denaturation of proteins;

Unit III:

Nucleic acids and Porphyrins– structure, function and their properties; Structural polymorphism of DNA, RNA; Structural characteristics of RNA; Chemistry of Porphyrins – Heme, Cytochromes, Chlorophylls, xanthophylls, Bacteriochlorophylls & algal pigments, Carotenoides.

Unit IV:

Vitamins and mineral metabolism– Sources, Chemistry and biochemical functions of water-soluble and fat soluble vitamins Mineral metabolism – phosphorus, potassium, calcium and Trace elements – molybdenum, zinc, manganese, cobalt and copper; Influence of minerals on the production of toxins; Role of trace elements on microbial enzymes.

Recommended Books:

1. Biochemistry by Voet & Voet.
2. Outlines of Biochemistry Conn, Stumpf, Bruening & Doi.
3. Biochemistry by Stryer.
4. Biochemistry by Zubay.
5. Principles of Biochemistry by Lehninger, Nelson & Cox.

ADITYA DEGREE & PG COLLEGES (A)
KAKINADA
Dept. of Microbiology
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I SEMESTER
MB104- ANALYTICAL TECHNIQUES

Hours/Week: 4 **Credits: 4**

Learning Outcomes
LO1: Comprehending the fundamentals and uses of both basic and sophisticated microscopy
LO2: Technical proficiency in specimen fixation and sample preparation techniques
LO3: Outlining the principles of biomolecule spectroscopic analysis
LO4: Comprehensive knowledge of centrifugation's types, principles, and applications
LO5: Highlighting the principles of radiochemical analysis and how they are used

Course Outcomes:
CO1: Outlining the fundamental ideas of both quantitative and qualitative analysis of a particular sample.
CO2: Understanding the operation of electron, fluorescence, and phase microscopes
CO3: Examining several spectroscopic methods and their uses
CO4: Understanding the Absorption and Radiation Laws
CO5:Understanding the concept and operation of radioisotopic tracers

Unit I
Microscopy – Principles of light, phase, fluorescent & electron microscopes; Microtomy sectioning; Microscopic techniques- Basic principles and applications of phase – contrast microscopy, fluorescent microscopy and electron microscopy, types of electron microscopy – scanning and transmission, sample preparations - fixing of specimens, preparation of blocks, microtomy and staining, negative staining techniques of biological samples, cytometry and flow cytometry

Unit II:
Principles of Centrifugation – Centrifugation techniques- preparative and analytical methods, density gradient centrifugation
General principles and applications of chromatography – Paper, Column, Thin layer, Gas, Ion exchange, Affinity chromatography, HPLC, FPLC and Gel filtration;
Electrophoresis – moving boundary, zone (Paper Gel) electrophoresis; Immunoelectrophoresis; Immunoblotting; Isoelectric focusing, 2-D electrophoresis

Unit III:
Laws of absorption and radiation; Principles, instrumentation and applications of Visible, ultraviolet, infrared and mass spectrophotometry; Absorption spectra, fluorescence flame photometry, Principles of colorimetry, Turbidometry, Viscometry, NMR, ESR, ; Determination of size, shape and molecular weight of macromolecules – osmotic pressure, flow birefringence, optical rotatory dispersion.

Unit IV:

Radio isotopic tracers – methodology, problems of experimental design, radiometric analysis, stable and radioactive isotopes, preparation, labeling, detection and measurement of isotopes; RIA; Manometric techniques; Freeze drying and its application in biological systems.

Recommended Books:

1. Instrumental Methods of Chemical Analysis by Chatwal & Anand.
2. Practical biochemistry: principles and techniques by Wilson & Walker.
3. Biochemical methods by Sadasivam & Manickam.
4. Biophysical chemistry: principles and techniques by Upadhyay, Upadhyay & Nath.

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I SEMESTER PRACTICALS

MB105 - GENERAL MICROBIOLOGY LAB

1. Pour plate, Streak plate and Dilution methods.
2. Staining methods
3. Detection of motility by hanging drop method.
4. Crystal violet blood agar, Salt nutrient agar.
5. Quantitative estimation of microorganisms – total and viable counts.
6. Bacterial growth measurement.

MB106 - BACTERIOLOGY AND VIROLOGY LAB

1. Culturing of anaerobic microorganisms.
2. Biochemical tests – Catalase and Oxidase tests; Indole reaction; Methyl red and Voges-Proskauer reactions.
3. Isolation of phage from soil
4. Cultivation of animal viruses in embryonated chicken eggs.
5. Mechanical inoculation of plant viruses – TM.
6. Measurement of size of spores and cells.
7. Observation of specimen and permanent slides.

MB107 - BIOMOLECULES LAB

1. Qualitative tests of carbohydrates
2. Qualitative tests of proteins.
3. Estimation of reducing sugar-Anthrone method
4. Estimation of sugar by titration method –Benedict's method
5. Estimation of Ninhydrin method, Ultraviolet spectroscopy of proteins.
6. Determination of saponification value of fats
7. Determination of iodine number of oils
8. Estimation of cholesterol.
9. Estimation of DNA by DPA method.
10. Estimation of RNA by orcinol method.

MB108 - ANALYTICAL TECHNIQUES LAB

1. Determination of pKa and pI values of amino acids.
2. Paper Chromatography of amino acids and sugars.
3. Colorimetric determination of any one amino acid.
4. Separation of pigments by adsorption chromatography.
5. Thin Layer chromatography separation – sugars & lipids.
6. Molecular weight determination of enzymes / proteins SDS-PAGE.
7. Subcellular fractionation by differential centrifugation.
8. Demonstration of GM counter.

ADITYA DEGREE & PG COLLEGES (A)
KAKINADA
Dept. of Microbiology
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II SEMESTER
MB201 MICROBIAL PHYSIOLOGY AND METABOLISM
Hours/week:4 **Credits :4**

Learning Objectives

LO1: Recruiting microbial communities according to their energy and nutritional needs
LO2: Comprehensive understanding of nitrogen fixing biology
LO3: Learning about the ideas behind microbial cross-talk.
LO4: Perception of amino acid production and control
LO5: Being aware of how secondary metabolites are used

Course Outcomes

CO1: Comprehending the complexities of microbial growth, metabolism, and energy production
CO2: Learning about the anabolic and catabolic reaction pathways
CO3: Gaining knowledge about the metabolism of amino acids
CO4: Stressing microbial communication, energetics, and different fermentation pathways
CO5: Listing how secondary metabolites are used

Unit I:

Nutritional types – autotrophic bacteria, chemosynthetic and photo synthetic microorganisms; Heterotrophic bacteria – saprophytes, parasites and mixotrophs; Respiration in bacteria – aerobic and anaerobic types of respiration, obligate aerobes, facultative anaerobes and obligate anaerobes; Toxic effect of oxygen on anaerobes; Bioluminescence in microorganisms; Energy yields;

Microbial growth- The concept of growth and definition, Cell cycle in microbes and generation time- Growth phases of bacteria –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; Physiology and biochemistry of sporulation and germination of spores.

Unit II:

Carbohydrate metabolism in microbes – synthesis of carbohydrates in photosynthetic, chemosynthetic and heterotrophic microbes; Fermentation of carbohydrates by microorganisms – Embden-Meyerhof-Parnas pathway, Entner-Doudoroff (ED) pathway, C2, C4 split pathway; Kreb's cycle, glyoxylate cycle, hexose monophosphate shunt (HMP), gluconeogenesis, anaplerotic reactions, synthesis of peptidoglycans and glycoproteins; Anaerobic respiration - Nitrate and sulphate respiration.

Unit III:

Metabolism of amino acids –Biosynthesis of amino acids and their regulation with emphasis on tryptophan and histidine by microorganisms; Protein metabolism - Assimilation of inorganic nitrogen and sulphur, Biochemistry of nitrogen fixation; Urea cycle; Signal transduction with reference to nitrogen metabolism; Catabolism of amino acids, transamination, decarboxylation and oxidative deamination; Porphyrin biosynthesis and catabolism.

UNIT IV:

Lipid metabolism - Biosynthesis of triacylglycerols, phospholipids and sphingolipids; Oxidation of saturated and unsaturated fatty acids; Microbial metabolism of aromatic and aliphatic hydrocarbons (camphor, 2,4-D and toluene); Nucleotide metabolism - Biosynthesis of purine and pyrimidine nucleotides, biosynthesis of deoxyribonucleotides; Regulation of nucleotide synthesis, catabolism of purine and pyrimidines; Secondary metabolism - Utilization of secondary metabolites for production of vitamins, toxins(aflatoxin and corynebacterial), hormones (GA), and antibiotics (penicillin and streptomycin).

Recommended Books:

1. An introduction to bacterial physiology by Price and Stevens.
2. Microbial energetic by Dawes.
3. Principles of Biochemistry by Lehninger, Nelson and Cox.
4. Microbial physiology and Metabolism by D.R.Caldwell, Wm.C.Brown Publ.
5. Microbiology by Prescott et al. Wm.C.Brown Publ.
6. Molecular Cell Biology by Lodish et al.

ADITYA DEGREE & PG COLLEGES (A)
KAKINADA
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M.Sc., Microbiology
II SEMESTER
MB202 Cell Biology and Enzymology

Hours/Week: 4 **Credits: 4**

Learning Outcomes

LO1: Comprehending the molecular and biological elements of respiration and photosynthesis
LO2: Perception of fundamental understanding of enzyme kinetics, enzymatic reaction parameters, and enzyme and inhibitor mechanisms of action.
LO3: Gaining understanding of the composition of enzymes and their active locations
LO4: Highlighting the fundamental ideas, vocabulary, and methods of enzymology
LO5: Using receptor proteins to deep understand signal transduction and signaling pathways

Course Outcomes

CO1: Outlining the biogenesis and importance of cellular organelles.
CO2: Understanding the physical-chemical characteristics of microorganisms
CO3: Denoting the transport process and cellular permeability
CO4: Gaining understanding of the signal transduction process
CO5: Knowing the principles of thermodynamics

Unit I:

Structure & function of chloroplast and mitochondria, mesosomes, lysosomes and cytoskeletal system; Photosynthesis in bacteria; Physicochemical properties of bacteria – intracellular osmotic pressure, permeability of the bacterial cell; Nutrient transport – simple diffusion, active, passive and facilitated diffusion; Purple green photosynthetic bacteria;Photosynthesis - Oxygenic and anoxygenic photosynthesis, structure of synthetic pigments of PS I and PS II, and photosynthetic electron transport, CO2 fixation, halobacterial photosynthesis.

Unit II:

Cell cycle – Mitosis and Meiosis; cell cycle regulation mechanism; Signal transduction- Protein kinases, phosphorylation cascades, Ras pathway, MAP kinase pathway, etc; Cyclic nucleotides, G proteins; Mechanisms of protein translocation across membranes in prokaryotes, coated vesicles, membrane receptors.

Unit III:

Outlines of enzyme classification, nomenclature, assay of enzymes and kinetics of enzyme catalyzed reactions – Michaelis – Menton equation, determination of Km, Vmax and Kcatvalues; Factors affecting enzyme reaction – pH, temperature, radiation, enzyme and substrate concentrations, activators, coenzymes and metalloenzymes; Ribozymes and abzymes.

Unit IV:

Enzyme inhibitors, competitive and noncompetitive inhibition; Active site determination; Mechanism of action of ribonuclease, lysozyme and chymotrypsin; Isoenzymes, Regulatory enzymes – covalent modification, zymogen activation, Allosteric enzymes – ATCase, Glutaminesynthetase; Hemoglobin& Myoglobin; Enzyme purification - Methods of isolation,

purification; Recovery and yield of enzymes; Criteria for testing purity of enzyme preparations; Immobilised enzymes - Methods of immobilisation; Applications of immobilized enzymes.

Recommended Books:

1. Cell and Molecular Biology by E.B.P. De Robertis, Lippincott Williams & Wilkins.
2. Molecular Cell Biology by Lodish& Baltimore.
3. Fundamentals of Enzymology, Nicholas C. Price, Lewis Stevens, Oxford University Press.
4. Principles of Biochemistry by Lehninger, Nelson and Cox.
5. Biochemistry by LubertStryer.
6. Enzymes by Dixon and Webb.
7. Introduction to Experimental Cell Biology by Ahern, Mc. Graw Hill, USA.
8. Cell Biology by Alberts, Bay Johnson.

ADITYA DEGREE & PG COLLEGES (A)
KAKINADA
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II SEMESTER
MB203 MOLECULAR AND MICROBIAL GENETICS

Hours/Week: 4 **Credits: 4**

Learning Outcomes
LO1: Gaining understanding of the intricate relationships between genes and multigene families
LO2: Molecular-level perception of recombination mechanisms LO3: In-depth comprehension of site-directed mutagenesis
LO4: Comprehending gene mapping and tetrad analysis
LO5: Stressing the employment of viruses as genetic tools and their recombination

Course Outcomes
CO1: Investigating the molecular genetic structure of prokaryotes and eukaryotes
CO2: Observing the intricate structural examination of genes
CO3: Listing the features and biological relevance of plasmids
CO4: Learning about transposable components in Drosophila and yeast
CO5: Gaining understanding of the mechanisms underlying mutations and their significance for evolution

Unit I:
Molecular organization of chromosomes in Prokaryotes and Eukaryotes; Centromeres and telomeres; Recombination at molecular level, heteroduplex analysis; Fine Structure analysis; Organisation of genomes – Repeated sequences - C value – cot curves" Multigene families; Molecular markers(RFLP and RAPD) Polymorphisms; Yeast & Drosophila as model organisms; Complementation and functional allelism.

Unit II:
Plasmids – types, plasmid DNA properties; Sex plasmid, F and its derivatives, drug resistance (R) plasmids; The Ti plasmid of Agrobacterium; Hybridization in yeast, control of mating type loci in yeast; Transposable elements – transposition; Types of bacterial transposons, duplication of target sequence at an insertion site; Deletion and inversion caused by transposons; Transposable elements in yeast and Drosophila; Retroposons.

Unit III:
Mutations –types of mutations, Molecular basis of mutations, isolation & analysis of mutants; Mutagenesis – base analogue mutagens, chemical mutagens, intercalating substances, mutator gene; Site directed mutagenesis, mutational hot spots, Reversion, second site revertants, frame shift mutations, carcinogens, screening of mutants; UV damage of DNA and repair.

Unit IV:
Bacterial genetics – Inheritance of characteristics and variability; Phenotypic changes due to environmental alterations; Genotypic changes; Bacterial recombination; Bacterial conjugation; Transduction – Generalized and specialized transductions; Bacterial transformation; Tetrad analysis in eukaryotic microbes – Neurospora and yeast; Mapping of

bacterial chromosome by interrupted mating and transduction; Recombination in bacteriophages; Benzer's studies on r-II locus of T4 bacteriophage; Complementation test.

Recommended Books:

1. Cell and Molecular Biology by E.B.P. De Robertis, Lippincott Williams & Wilkins.
2. Molecular Cell Biology by Lodish& Baltimore.
3. Molecular Biology of the Gene by Watson Roberts, Steitx Wainer, Benjamin/Cummings Publishing Company Inc.
4. Genes – VII by Benjamin Lewen.
5. Essentials of Genetics by Russell.
6. Genetics by Gardener.
7. Molecular Genetics of Bacteria, J.W. Dale, Wiley Publ.
8. Modern Genetic Analysis by Griffith.

ADITYA DEGREE & PG COLLEGES (A)
KAKINADA
Dept. of Microbiology
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II SEMESTER
MB204 IMMUNOLOGY

Hours/Week: 4 **Credits: 4**

Learning Outcomes

LO1: Comprehending Innate, Adaptive, and Immunogenicity
LO2: Comprehensive understanding of autoimmunity, histocompatibility, and antigenic-antibody interactions
LO3: How Hybridoma technology is perceived and what it means
LO4: Learn about immunological tolerance and immunosuppression in theory.
LO5: Creating a theoretical framework for immunological methods

Course outcomes

CO1:An outline of the immune system, antigen-antibody interactions, and structure
CO2: Gaining a deeper comprehension of both adaptive and innate immunity.
CO3 Theoretical understanding of hypersensitive reactions and autoimmune diseases
CO4: Highlighting MHC's function in the immunological response.
CO5: Highlighting the importance of vaccinations in preventing and controlling disease

Unit I:

History and scope of immunology, cells involved in immune system – T-lymphocytes, B lymphocytes, monocytes, macrophages, APC, Neutrophils, mast cells; Types of immunity Adaptive immunity, innate immunity; Lymphoid organs, Thymus, bone marrow, spleen, lymph nodes; Antigen-Antibody reactions - Ag-Ab binding, agglutination, blood groups, immunoflourescence and important immunological diagnostic tests - ELISA, RIA, immunoblot, Immunodiffusion, Immunoelectrophoresis, Complement fixation test (CFT).

Unit II:

Nature of antigens; antibody structure, classification of antibodies, functions of IgG, IgA, IgM, IgD and IgE; primary and secondary immune response; serological analysis of antibodies – isotypes, allotypes and idiotypes; Antibody diversity, antigen receptors on B and T lymphocytes; Phagocytosis, opsination, Opsonins and polyclonal and monoclonal antibody production (Hybridoma techniques) – Applications of monoclonal antibodies in biomedical research, clinical diagnosis and treatment; The complement system - components of classical and alternative complement pathways, complement receptors, biological, consequences of complement activation.

Unit III:

Humoral and cell-mediated immunity, ontogeny of B and T lymphocytes, generation of memory B cells and affinity maturation; T and B cell interactions, cytokines, lymphocyte mediated cytotoxicity (CTL); Antibody-dependent cell-mediated cytotoxicity; Reactions of immunity – antitoxins, neutralization of toxin with antitoxin; Immune response to infectious diseases: viral infections, bacterial infections, and protozoan diseases.

Unit IV:
Graft versus host reactions - Major Histocompatibility Complex (MHC); Human leucocyte antigen (HLA) restriction, Hypersensitive reactions – Auto immunity, transplantation immunity, Tumor immunology, immunological tolerance and immunosuppression; Immunodeficiency diseases - Primary immunodeficiency (genetic) diseases due to B-cell and T-cell and combined defects (hypogammaglobulinemia, thymic aplasia, SCID); Secondary immunodeficiency (acquired); Principles of immunization; vaccinoprophylaxis, vaccinotherapy, serotherapy.

Recommended Books:

1. Cellular and Molecular Immunology by Abul K. Abbas et al.
2. Textbook of Immunology by Barret.
3. Essential Immunology by Roitt, Brostoff, Male, Harcourt Brace & Company, Mosby
4. Immunology by J.Kuby, Richard A. Goldsby, Thomas J. Kindt, Barbara A. Osborne, Freeman & Company Mosby publishers**.**

ADITYA DEGREE & PG COLLEGES (A)
KAKINADA
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II SEMESTER PRACTICALS

Hours/Week: 4 **Credits: 4**

MB205 MICROBIAL PHYSIOLOGYAND METABOLISM LAB

1. Estimation of proteins by Biuret method and FolinCiocalteau method.
2. Estimation of DNA by Diphenyl amine method.
3. Estimation of RNA by Orcinol method
4. Estimation of Inorganic and organic phosphates by Fiske-SubbaRow method.
5. Estimation of Ammonical nitrogen and nitrates.
6. UV Survival curve of E.coli. or any other bacteria.

MB206 CELL BIOLOGYAND ENZYMOLOGY LAB

1. Protoplast preparation and regeneration.
2. Observation of mitosis in Onion root tips.
3. Observation of meiosis in Flower buds.
4. Assay of microbial enzymes (any two) – Amylase, protease, catalase, urease and pectinase.
5. Production, isolation, purification and assay of any one of the above enzymes
6. Enzyme Kinetics: (any one of the above enzymes):

a) Effect of substrate and enzyme concentration on enzyme activity; Determination of Km and Vmaxvalues.

b) Effect of pH, temperature and inhibitors on enzyme activity.

MB207 MOLECULAR AND MICROBIAL GENETICS LAB

1. Demonstration of Ames test.
2. Strain improvement using chemical mutagens.
3. Isolation of mutants using EMS.
4. Study of the repair mechanism for the damage caused by UV radiation.
5. Chromosome isolation, banding and Karyotyping.
6. Bacterial conjugation

MB208 IMMUNOLOGY LAB

1. Separation of Serum - Immunoelectrophoresis.
2. Ouchterlony double diffusion.
3. Radial immunodiffusion.
4. Immunoprecipitation and precipitin curve.
5. ELISA.
6. Western blotting.
7. Agglutination inhibition test.
8. Blood grouping, Rh typing, VDRL, WIDAL

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I SEMESTER
GENERAL MICROBIOLOGY

SEMESTER END EXAMINATION MODEL QUESTION PAPER

Time: 3hours **Max. Marks: 75**

Answer ALL questions.
All questions carry equal marks

Section-A 4X15=60 marks

1. a) Discuss the various kingdoms of organisms and classification criteria of phylogenetic tree.

(OR)

b) Explain the importance of Bergy's Manual classification in bacterial taxonomy.

2. a) Write the sterilization techniques for the control of microorganisms.

(OR)

b) Explain the different staining and culturing methods of microorganisms.

3. a) Explain the growth kinetics of microbial cells.

(OR)

b) Discuss the ultrastructure and chemical composition of spirochetes and rickettsiae.

4. a) Discuss the economic importance of fungi with examples.

(OR)

b) Write Fritsch's classification of algae with their economic importance.

Section-B 5X3=15 marks

5)Answer any **FIVE** of the following:

a) Numerical Taxonomy
b) Flagella \
c) Microsomes
d) Enrichment media
e) Synchronous culture
f) Mycoplasma
g) Slime mold
h) Plasmodium

ADITYA DEGREE & PG COLLEGES (A)
KAKINADA
Dept. of Microbiology
M.Sc., Microbiology
I SEMESTER
Bacteriology & Virology

Time: 3hours Max. Marks: 75

Answer ALL questions.
All questions carry equal marks

Section-A 4X15=60 Marks

1. a) Explain the reproduction modes of bacteria.

(OR)

b) Discuss the ultrastructure, chemical composition and life cycle of Mycobacterium.

2. a) Brief out the industrial and ecological importance of bacteria.

(OR)

b) List the bacterial sensitivity tests and the factors contributing for the antibiotic resistance.

3. a) Discuss the physicochemical and biological properties of viruses.

(OR)

b) Explain the isolation, cultivation and maintenance of viral culture.

4. a) Discuss the structure, complexity and diversity of viral genomes.

(OR)

b) Explain the expression and vector mediated viral genome transmission.

Section-B 5X3=15 Marks

5. Answer any FIVE of the following:
   a) streptococcus
   b) Serial dilution
   c) Bio pesticides
   d) Antibiogram
   e) Viral envelope
   f) Monolayer cell culture
   g) Positive sense of RNA genome
   h) Interferon therapy

ADITYA DEGREE & PG COLLEGES (A)
KAKINADA
Dept. of Microbiology
M.Sc., Microbiology
I SEMESTER
BIOMOLECULES

Time: 3hours Max. Marks: 75

Answer ALL questions.
All questions carry equal marks

Section-A 4X15=60 Marks

1. a) Explain the physicochemical properties and biological role of monosaccharides.
(OR)
b) Describe the classification, structure and properties of fatty acids.

2. a) Write the different structural confirmations of proteins.
(OR)
b) Explain protein sequencing and characterization by various methods.

3. a) Write the chemical structure, dietary sources, biochemical function and deficiency diseases of vitamins.
(OR)
b) Explain the structure, function and properties of DNA.

4. a) Describe the bacterial photosynthesis and the photosynthetic electron transport system.
(OR)
b) Describe the role of trace elements in Microbial enzymes.

Section-B 5X3=15 Marks

5. Answer any FIVE of the following:
a) stereoisomerism
b) Prostaglandins
c) Denaturation
d) Isoelectric point
e) cytochromes
f) Cot curve
g) Redox carriers
h) Trace elements

ADITYA DEGREE & PG COLLEGES (A)
KAKINADA
Dept. of Microbiology
M.Sc., Microbiology
I SEMESTER
ANALYTICAL TECHNIQUES

Time: 3hours Max. Marks: 75

Answer ALL questions.

All questions carry equal marks

Section-A 4X15=60 Marks

1. a) Explain the principle, instrumentation, and applications of Microscopy.

(OR)

b) Describe the principle, instrumentation and applications of preparative and analytical ultracentrifugation.

2. a) Describe the principle, and application of ion exchange and affinity chromatography.

(OR)

b) What is vertical electrophoresis? Write the principle, instrumentation, and applications of SDS PAGE.

3. a) Write the principle, instrumentation, and uses of UV, visible, infrared spectroscopy.

(OR)

b) Describe the principle and applications of X ray diffraction.

4. a) What is radioactive? Explain about liquid scintillation counter.

(OR)

b) What is freeze drying? Explain its applications in biological system

Section-B

5. Answer any FIVE of the following: 5X3=15 Marks

a) Fluorescence
b) NMR
c) TLC
d) Lyophilization
e) Agarose
f) Isoelectric focusing
g) Isotope
h) Density gradient centrifugation

ADITYA DEGREE & PG COLLEGES (A)
KAKINADA
Dept. of Microbiology
M.Sc., Microbiology
II SEMESTER
MICROBIAKL PHYSIOLOGY AND METABOLISM

Time: 3hours Max. Marks: 75

Answer ALL questions.
All questions carry equal marks

Section-A 4X15=60 Marks

1. a) Discuss the modes of respiration and nutritional types in microorganisms.
(OR)
b) Describe the growth kinetics and methods of growth measurement in microorganisms.

2. a) Discuss the fermentation of microorganisms by Embden –Meyerhof pathway.
(OR)
b) Explain the synthesis of peptidoglycans and glycoproteins.

3. a) Discuss the synthesis of histidine by microorganisms.
(OR)
b) Explain the mechanism of transamination reactions.

4. a) Explain the bio synthesis of fatty acids.
(OR)
b) Describe the denovo pathway of purine biosynthesis.

Section-B 5X3=15 Marks

5. Answer any FIVE of the following:
a) Synchronous culture
b) Germination of spores
c) Glyoxylate cycle
d) Chemosynthetic microbes
e) Decarboxylation
f) Signal transduction
g) Unsaturated fatty acids
h) Aflatoxin

ADITYA DEGREE & PG COLLEGES (A)
KAKINADA
Dept. of Microbiology
M.Sc., Microbiology
II SEMESTER
MB202 Cell Biology and Enzymology

Hours/Week: 4 **Credits: 4**

Time: 3hours Max. Marks: 75

Answer ALL questions.
All questions carry equal marks

Section-A 4X15=60 Marks

1. a) Discuss the structure and function of mitochondria.

(OR)

b) Write about plasma membrane structure, composition and its functions.

2 a) Discuss the mechanism of G proteins and their signal transduction.

(OR)

b) Explain the process of meiotic division in a cell.

3. a) Describe the kinetics of enzyme substrate reaction.

(OR)

b) Explain the methods to determine the enzyme activity.

4. a) Discuss the mechanism of ribonuclease enzyme catalysis.

(OR)

b) Give a brief description on different types of enzyme inhibitions.

Section-B 5X3=15 marks

5. Answer any FIVE of the following:
a) Mesosomes
b) PS I & PS II
c) Ras pathway
d) Cyclic nucleotides
e) Vmax and Kcat
f) Coenzymes
g) Myoglobin
h) Immobilized enzymes

ADITYA DEGREE & PG COLLEGES (A)
KAKINADA
Dept. of Microbiology
M.Sc., Microbiology
II SEMESTER
MB203 Molecular Microbial Genetics

Time: 3hours Max. Marks: 75

Answer ALL questions.
All questions carry equal marks

Section-A 4X15=60 Marks

1. a) Discuss the molecular organization of chromosomes.
(OR)
b) Write about molecular workers to detect gene polymorphisms.

2. a) What are plasmids? Give an explanation on drug resistance (R) plasmids.
(OR)
b) Describe about transposable elements and their functions

3. a) Discuss about molecular basis of gene mutations.
(OR)
b) Describe the site directed mutagenesis and methods to screen mutants.

4. a) Explain the process of bacterial conjugation.
(OR)
b) Describe the mapping of bacterial chromosome by interrupted mating and transduction.

Section-B 5X3=15 Marks

5. Answer any FIVE of the following:
a) Cot cures
b) Telomere
c) Sex plasmid
d) Retroposons
e) Intercalating substances
f) Carcinogens
g) Inheritance
h) Tetrad analysis

ADITYA DEGREE & PG COLLEGES (A)
KAKINADA
Dept. of Microbiology
M.Sc., Microbiology
II SEMESTER
MB204 Immunology

Time: 3hours Max. Marks: 75

Answer ALL questions.
All questions carry equal marks

Section-A 4X15=60 Marks

1. a) Write about various immune cells of the body.
(OR)
b) Discuss about ELISA test to diagnose immune cells.

2. a) Describe the structure, classification and function of immunoglobulins .
(OR)
b) Explain the components and function of the compliment system.

3. a) Write about the differentiation and maturation of T-Lymphocytes.
(OR)
b) Discuss the anti-body dependent cell mediated cytotoxicity.

4. a) Describe hypersensitive types of classes and their effects.
(OR)
b) What is auto immunity? Discuss with types and examples.

Section-B 5X3=15 Marks

5. Answer any FIVE of the following:
a) Neutrophils
b) Immune diffusion
c) Phagocytosis
d) Mono clonal anti bodies
e) Memory B-cell
f) CTL
g) Immuno suppression
h) SCID

ADITYA DEGREE & PG COLLEGES (A)
KAKINADA
Dept. of Microbiology
M.Sc., Microbiology

Credits :3

Time: 3 Hrs **Max.Marks: 38**

I. Major Experiment	1x15	:15 Marks
II. Minor Experiment	1x8	:8 Marks
III. Identification of spotters	2x2 1/2	:5 Marks
IV. Viva		5 Marks
V. Record		5 Marks

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ADITYA DEGREE COLLEGE (A)
KAKINADA
Dept. of Microbiology
M.Sc., Microbiology

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Unit	Essays	Shorts
Unit 1	2	2
Unit 2	2	2
Unit 3	2	2
Unit 4	2	2
Total	**08** **Out of 08, 4 questions should be answered** **4x15=60 Marks**	**8** **Out of 8, 5 questions should be answered** **5x3=15 Marks**

ADITYA DEGREE COLLEGE (A)
KAKINADA
Dept. of Microbiology

PANEL OF QUESTION PAPER SETTERS AND EXAMINERS

S.No	Name of the Examiners	Subject	Name of the College
1.	Prof. A. Amrutha Valli	Microbiology	HOD, Department of Microbiology ANU, Guntur
2.	Prof. D. Vijaya Lakshmi	Microbiology	HOD,Department of Microbiology, YVU ,Kadapa
3.	Dr. G. Rajeswari	Microbiology	HOD, Govt. Medical College, Rajahmundry
4.	Dr. A. Padmavathi	Microbiology	Ch. S. D .St. Theresa's College For Women (A) Eluru, West Godavari
5.	Dr. K. Aruna	Microbiology	SRR &CVRGovernmentCollege (A) Vijayawada
6.	Prof. Ch. Paramageetham	Microbiology	HOD,SVU, Tirupathi
7.	Dr. T. Varalakshmi	Microbiology	Visakha Government Degree College for Women (A), Viskhapatnam
8.	Prof. G. Narasimha	Microbiology	SVU, Tirupathi
9.	Dr. B. Lakshmi	Microbiology	P R G College (A) Kakinada
10.	Prof. R. Jaya Madhuri	Microbiology	SPMVV, Tirupathi

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