Syllabus For

M.Sc. MICROBIOLOGY

(FOUR SEMESTER COURSE FOR COLLEGES)

ACADEMIC SESSION

JULY (2024-2026)



Jiwaji University, Gwalior

(NAAC accredited 'A++' grade University)



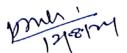
Scheme of Examination

M.Sc. I Semester

No. of papers.	Name of papers	Max. Marks	Theory	CCE	Minimum passing marks in Theory	Minimum Practical passing Marks
MB:101	Basics in Microbiology and General Bacteriology	100	85	15	29	
MB:102	Virology and Mycology	100	85	15	29	
MB:103	Cell Biology and Biochemistry	100	85	15	29	
MB:104	Bioinstrumentation	100	85	15	29	
MB:105	Lab course- I	100				40
MB:106	Lab course- II	100				40
	Total	600	340	60		

M.Sc. II Semester

No. of papers.	Name of papers	Max. Marks	Theory	CCE	Minimum passing marks in	Minimum Practical passing
			in the second		Theory	Marks
MB:201	Microbial genetics and Molecular biology	100	85	15	29	
MB:202	Immunology	100	85	15	29	
MB:203	Microbial Physiology end Metabolism	100	85	15	29	
MB:204	Biostatistics, Computer Application and Bioioformarics.	100	85	15	29	
MB:205	Lab course- I	100				40
MB:206	Lab course- II	100				40
	Total	600	340	60		

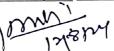


M.Sc. III Semester

No. of papers.	Name of papers	Max. Marks	Theory	CCE	Minimum passing marks in Theory	Minimum Practical passing Marks
MB:301	Medical and Pharmaceutical Microbiology	100	85	15	29	
MB:302	Recombinant DNA Technology	100	85	15	29	
MB:303	Fermentation And Microbial Technology	100	85	15	29	
MB:304	Environmental Microbiology	100	85	15	29	
MB:305	Lab course- I	100				40
MB:306	Lab course- II	100				40
	Total	600	340	60		

M.Sc IV Semester

No. of papers.	Name of papers	Max.	Theory	CCE	Minimum	Maximum practical
		Marks			pass marksin	passing marks
					theory paper	
MB:401	Agriculture	100	85	15	29	
	Food	η,			4	
MB:402		100	85	15	29	
	Microbiology					
MB:403	Lab course	100 -	-	-		40
MB:404	Project work of 3-	300	- ,	-	120	
•	4 months duration					
	Total	600	170	30		



MB: 101 BASICS IN MICROBIOLOGY AND BACTERIOLOGY

UNIT-I

- 1. Introduction, history and scope of Microbiology.
- 2. General characteristics and composition of Prokaryotes and Eukaryotes.
- 3. Classification of Microorganisms. Hacckel's three kingdom concept, Whittaker's five kingdom concept. Three domain concept of Carl Woes', classification and salient features of bacteria according to Bergey's Manual of Determinative Bacteriology.
- 4. Nomenclature and modern methods of Bacterialtaxonomy.

UNIT-II

- 1. Morphology and ultra structure of bacteria: size, shape, and arraignment of bacteria, ultra structure of bacterial cell wall of eubacteria and archeabacteria. Protoplast and spheroplast formation and L-form.
- 2. Components external to cell wall: Structure and function of flagella, fimbriae and pilli, capsule-types, composition and function, slime layers. S-layers.
- 3. Prokaryotic cell membrane and cytoplasmic matrix cell membrane structure and function of bacteria and archeobacteria, mesosomes, ribosomes, cytoplasmic inclusion bodies (polyhydroxy butyrate, polyphosphate granules, oil droplets, cyanophycin granules) and nucleoid.
- 4. Bacterial response to external stimulus and bacterial endospores: Chemotaxis and phototaxis structure, formation and germination of bacterial endospore.

UNIT-III

- 1. Bacterial nutrition: Basic nutritional requirements, growth factors, nutritional categories, physical requirements of bacterial growth.
- ?. Bacteriological media: types (complex. synthetic, differential, enrichment and selective media) and their uses. Culture characteristics of bacteria on different media.
- 3. Cultivation of bacteria: aerobic and anaerobic culture, pure culture techniques, shaker and still culture, maintenance and preservation of microbial culture.
- 4. Bacterial growth: growth kinetics, growth curve. Batch, continuous and synchronous culture. Measurement of growth and influence of environmental factors affecting growth.

UNIT-IV

- 1. General concept of Prokaryotic and Eukaryotic genome. Genome off. E. coli.
- 2. Genetic recombination and transformation.
- 3. Transduction: generalized and specialized transduction, phage conversion.
- 4. Plasmid: types and their significance. Conjugation and chromosomal mobilization. *E. coli* as model prokaryotes.

UNIT-V

- 1. Staining methods: fixation, types of dyes, simple staining, differential staining (Gram and Acidfast staining), staining of specific structures (capsule, flagel 1a and spore staining)
- 2. Control of microorganisms: Microbial death curve, concept of bio-burden, thermal death time and decimal reduction time. Factors influencing the effectiveness of antimicrobial agents.
- 3. Control of microorganisms by physical agents: heat (moist and dry), filtration and radiation.
- 4. Chemical control of microorganisms: Halogens, phenol and other phenolic compounds, heavy metals, alcohols, ethylene oxide and aldehydes.



- 1. Microbiology, Lansing M Prescott, John P. Harley. Donald A Klein, Sixth edition, Me Graw Hill Higher education.
- 2. General Microbiology, R.Y. Ingraham, J.L. Wheels, M.L. Painter. Thess Macmillan Press Ltd.
- 3. Brock Biology of Microorganism, M.T. Martinko, J.M. Parker, Prentice-Hall.
- 4. Microbiology; M.J. Pelczar, E.C. S Chan and N.R. Kreig, Tata MacGraw Hill.
- Microbial Genetics, S.R. Molloy, J.E. Jr. Cronan and Frreifelder D Jones, Bartiett Publishers.
- 6. Breed and Buchanan. *Bergey's Manual of Systematic Bacteriology*. 2nd Edition, (Volumes. 1 5) (2001 2003).
- 7. General Microbiology, R. Y. Starter, E. A. Adelberg, J. L. Ingraham, 4+ edition, Mac Millan Press, London.
- 8. Microbiology an introduction by Tortora Funke case.





MB: 102 VIROLOGY AND MYCOLOGY

UNIT-I

- 1. Brief outline on discovery and origin of viruses.
- 2.General properties of viruses, morphology and ultra structure of viruses, capsid and their arrangements, types of envelopes and their composition, measurement of viruses.
- 3. Viral genome: their types and structure, viral related agents-viroids and prions.
- 4. Classification and general properties of major families of viruses including detail account of their mode of replication.

UNIT-II

- 1. Cultivation of viruses- in embryonated eggs, experimental animals and cell lines, primary and secondary cell lines, diploid cell culture.
- Assay of viruses: physical and chemical methods, plaque method, pock counting and end point method.
- 3. Serological methods: hemagglutination, hemagglutination inhibition, neutralization test, complement fixation, ELISA. RIA.
- 4. Purification of viruses: gradient centrifuge, electrophoresis, and chromatography.

UNIT-III

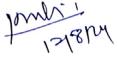
- 1. Plant viruses, recent advances in classification of plant viruses. Structure and pathogenicity of TMV.
- 2. Transmission of plant viruses with vector (insect, nematods and fungi) and without vector (contact, seed and pollens). Biochemical changes induced by virus in plant cell.
- 3. Animal viruses: nomenclature and classification of animal viruses.
- 4. General idea about Cyanophage, and Mycophage.

UNIT-IV

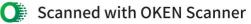
- 1. Bacteriophage: classification, morphology and ultra structure.
- 2. One step growth curve (latent period. eclipse period, and burst of size.)
- 3. Life cycle: lytic and lysogenic life cycle of bacteriophages.
- 4. Brief account of MI3, Mu, T4, B x174 and lambda phage.

UNIT-V

- 1. Structure, reproduction and classification of fungi. General characteristics of Zygomycetes, Ascomycetes, Basidiomycetes, and Deuteromycetes.
- 2. Cultivation of fungi, culture media for fungal growth, effects of environment on growth, isolation. Identification and preservation of fungi.
- 3. Dimorphic fungi, yeast morphology, general characteristics and reproduction. Lichens, Mycorrhiza, and Actinomycetes.
- 4. Ecology of fungi: concept of fungistatic, fungicidal.







- 1. Virology, Renato Dulbecco and Harold S. Crinsberg, Fourth edition, J.B. Lippincott Company, USA
- 2. An Introduction to viruses, S. B. Biswas and Amita Biswas. Forth edition, Vikas Publishing House PVT LTD New Delhi.
- 3. Textbook of Microbiology by Ananthnarayanan and Paniker's, eighth edition, Universities Press.
- 4. Microbiology; Lansing M Prescott, John P. Harley, Donald A Klein, Sixth edition, I'v1c Graw Hill Higher education.
- 5. Introductory Mycology, Alexopoulos, C.Jr:, Second edition, Wiley, New York

MB: 103 CELL BIOLOGY AND BIOCHEMISTRY

UNIT-I

- 1. Cell: size, shape, types & chemical composition of the cell.
- 2. Structural organization and function of intracellular organelles of eukaryotic cell: nucleus, mitochondria, golgibody, lysosomes, endoplasmic reticulum, peroxisomes, plastids, chloroplast, vacuole, cytoskeleton.
- 3. Membrane structure and function: molecular organization of cell membrane, membrane models, mechanisms of intracellular transport.
- 4. Cellular interaction: differentiation of cell membrane and intracellular communication and Gap junction

UNIT-II

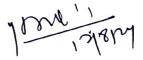
- 1. Cell differentiation: general characteristics of cell differentiation and cytoplasmic factors, differential gene action.
- 2. Cell signaling: cell surface receptor's, G-protein, signal transduction pathways.
- 3. Cell cycle: mitosis and meiosis and their regulation. Programmed cell death and apoptosis.
- 4. Cancer biology: characteristics of cancer cell, types of cancer, oncogene and tumor markers.

UNIT-III

- 1. Carbohydrates: structure of sugars, classification, properties. Chemical reactions, stereoisomerism and optical isomers of sugars.
- 2. Structure, properties and function of disaccharides, oligosaccharides, and polysaccharides, carbohydrate derivatives; peptidoglycan, glycoproteins, glycolipids.
- 3. **Lipids:** classification, structure, properties and functions of fatty acids, triacylglycerols, phospholipids, sterols and terpenes.
- 4. Lipids with specific biological functions, micelles and liposomes.

UNIT-IV

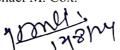
- 1. Amino acids: structure, classification, properties and functions.
- 2. Proteins: structural and functional proteins, synthesis of peptide bonds. Primary, secondary, tertiary and quaternary structure of proteins. Protein sequencing.
- 3. Nucleic acids. structure and properties of purines and pyrimidine bases. nucleosides and nucleotides.
- 4. Basic structure and types of DNA and RNA.



UNIT-V

- 1. Enzymes: basic concept as a biocatalyst, specificity, active sites, activity unit and isoenzymes, enzyme classification.
- 2. Enzyme kinetics- Michaelis-Menton equation for simple enzymes, determination of kinetic parameters.
- 3. Enzyme inhibition: competitive, noncompetitive and uncompetitive inhibition, allosteric enzymes.
- 4. Vitamins and cofactors: structure, distribution and biological properties.

- 1. Biochemistry by Donald Voet and Judith G. Voet, third edition, John Wiley and sons, mc., U.S.A.
- 2. Biochemistry by Jeremy M. Berg, John L. Tymoczko and Lubert Stryer, sixth edition, W. H. Freeman and Company, New York.
- 3. Molecular Cell Biology, by Harvey Lodish, Fifth edition, W.H. Freeman and Company, New York
- 4. Molecular Biology of The Cell by Bruce Alberts, Fourth edition, Garland Science Taylor and Francis Group, U.S.A.
- 5. Biochemistry by Lubert Stryer, Fourth edition, W. H. Freeman and Company. New York.
- 6. Biochemistry by Christopher K. Mathers, K.E.van Holde and Kevin G. Ahern, Third edition, Pearson Education (Singapore) Re. Ltd., Indian branck New Delhi
- 7 Lehninger Principles of Biochemistry by David L. Nelson and Michael M. Cox.



MB: 104 BIOINSTUMENTATION

UNIT-I

- 1. Microscopy: history and principles of microscopy, properties of light, magnification power, resolution limit, resolving power, numerical aperture.
- 2. Principles and applications of light microscopy, bright field, dark field, phase contrast and fluorescent microscopy. Determination of size of microorganisms by micrometry.
- 3. Principles and application of electron microscopy- transmission and scanning electron microscopy. Fixation and staining techniques in electron Microscopy.
- 4. Newer techniques in microscopy- confocal microscopy, scanning probe microscopy (scanning tunneling microscope and atomic force microscope).

UNIT-II

- 1. Chromatography: Principles, types and applications of partition, paper and thin layer chromatography.
- 2. Adsorption and Gel filtration chromatography: Principle, matrix, column packing and applications.
- 3. Affinity, ion exchange, and Gas chromatography: Principle and applications
- 4. High performance liquid chromatography (HPLC) and FPLC: Principle, Instrumentation (Reservoirs, pumps, columns) and applications

UNIT-III

- 1. Electrophoresis: principle, types and applications of Paper, Starch gel and Agarose gel electrophoresis.
- 2. Polyacrylamide Gel Electrophoresis: Native PAGE and SDS PAGE . .
- 3. Isoelectric focusing. Isotachophoresis and gradient gel electrophoresis.
- 4. Two dimensional gel electrophoresis and pulse field gel electrophoresis

UNIT-IV

- 1 . Spectroscopy: Laws of absorption, Principles, instrumentation and applications of colorimetry. UV-visible spectroscopy.
- 2. Principles, instrumentation and applications Infrared and fluorescence Spectroscopy.
- 3. Principles, instrumentation and applications of NMR and ESR.
- 4. Principles. Instrumentation and applications Mass Spectroscopy (types of ion source, analyzers and detectors), GB"-MS, MALDI-TOF. Jomy 12/8/14



UNIT-V

- 1. Centrifugation: Basic principles of centrifugation, differential and density gradient: zonal and isopyenic centrifugation. Sedimentation coefficient, factors affecting sedimentation coefficient.
- 2. Ultracentrifuges: analytical and preparative with application. Rotors: types and applications.
- 3. Radioisotope techniques: half life, radioactive decay, radioactive assay methods based on ionization and excitation of gases-Geiger muller counter, liquid scintillation counter and gamma counter.
- 4. Autoradiography- principle and applications. Quenching and application of radioisotopes in biological systems.

- 1. A Biologist Guide to Principles and Techniques of Practical Biochemistry, Wilson and Goulding
- 2. Physical Biochemistry: Applications to Biochemistry and Molecular Biology. David Frefelder,
- 3. Microbiology, Lffflsillh M Prescott, John P. Harley, Donald A Klem, Sixth edition. McGraw Hill Higher education.
- 4. Principles of Instrumental Analysis, Skoog and West
- 5. Biological Spectroscopy, Campbell and Dwek
- 6. Principles and Techniques of Biochemistry and Molecular Biology, Wilson Keith and Walker John (2005) 6th Edition. Cambridge University Press, New York,







MB: 105 Lab course I (Basics in Microbiology and Bacteriology & Virology and Mycology)

- 1. Good Microbiology laboratory practices: Laboratory safety of Dos and Don'ts), hazard from chemicals, handling of cultures and chemicals, disposal of chemicals and cultures.
- 2. Introduction to different Glass cares used in Microbiology Laboratory.
- 3. To leant handling of different instruments and Equipments used for culture and Sterilization.
- 4. To prepare basic liquid (Nutrient broth) and basic solid media (Nutrient Ajar and Potato Dextrose Agar for cultivation of bacteria and fungi.
- 5. To prepare selective, differential media and enriched media (Mac Conkey Agar and Blood Agar)
- 6. To learn pure culture techniques used for isolation and purification of microorganisms
- a. Streak plate method
- b. Pour plate method
- c. Spread plate method
- 7. Isolation and Enumeration of microorganisms from Air I plate exposure method), Soil and Water (serial dilution method)
- 8. To perform different staining methods to study morphological and structural characteristics of bacteria and fungi
- a. Gram Staining
- b. Acid fast staining
- c. Fungal staining (Lacto-phenol cotton blue)
- d. Spore staining
- e. Flagella staining
- f. Capsule staining (Negative staining)
- 9. To check motility o1 bacteria by hanging drop and semi solid agar methods
- 10 To learn culture preservation techniques I Agar slants, stabs and glycerol stocks)
- 1 1 T'o study effect of salt, pH and temperature on microbial growth

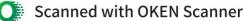




- 12. Determination of bacterial growth by turbidity measurements and to plot bacterial growth curve.
- 13. inoculation and cultivation of viruses in embryonated eggs.
- 14. Isolation of bacteriophage (coli phages) from sewage.
- 15. Enumeration of bacteriophage by plague forming unit method
- 16. Determination of one step growth curve of bacteriophase
- 17. Isolation cultivation and morphological studies of fungi
- 18 Isolation cultivation and morphological studies of Actinomycetes

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CHICA SPECIE



MB: 106 Lab course II (Cell biology and Biochemistry & Bioinstrumentation)

- 1. To detect the presence of earbohydrate in the given sample by Molish test
- 2. To detect the presence of reducing sugar in the given sample by Fehling s lest
- 3. To detect the presence of pentose sugar in the given sample by Brat's test
- 4. To detennine the presence of monosaccharide using Anthrone test
- 5. To detect presence of reducing sugar using, Benedict's test.
- 6. To determine the presence of monosaccharide using Barfoed's reagent
- 7. To determine the presence of starch in given sample by using iodine solution (starchiodine test)
- 8. To determine the presence of ketose sugar by Seliwanoff's reagent in given sample
- 9. To determine the presence of protein lay Biuret method
- 10. To determine the presence of protein by Xanthoprotic test.
- 11. Quantification of protein contents in given sample by Folin's- Lowry method
- 12. Todetermine Saponification value of given fat sample
- 13. Determination of pK a value.

- 14. To study different stages of mitosis in onion root tip preparations
- 15. Verification of Beer-Lambert Law
- 16 Determination of absorption maxima of given sample using spectrophotometer
- 17 Calibration of an ocular micrometer for different objectives of microscope.
- 18 Measurement of microorganisms by the use of an ocular micrometer.
- 19 Separation of given amino acids b paper chromatography Separation of amino acids by
- 20 Thin Layer chromatography To study microorganisms under dark-field microscope
- 21Separation of sub cellular organelles by differential centrifugation







MB: 201 MICROBIAL GENETICS AND MOLECULAR BIOLOGY

- 1. Organization of genetic material in prokaryotes and eukaryotes.
- 2. Concept of gene. Genome, genome size, C-value, and C-value paradox.
- 3. Nucleic acid as a Genetic information carriers: experimental evidence.
- 4. Gene is a unit of mutation and recombination: molecular basis of mutations, physical and chemical mutagens, spontaneous and induced mutation, selection of mutant.

UNIT-II

- 1. Structure of DBA, super helicity of DBA, linking number, topological properties and role of topoisomerase. DNA denaturation and renaturation.
- 2. DNA damage and repair: types of DNA damage (deamination, oxidative damage. alkylation and pyrimidine drawers.). Repair mechanism; mismatch repair, nucleotide excision repair. Recombination repair. SOS repair.
- 3. DNA replication: general principle, various mode of replication, unwinding of DNA helix, continuous and discontinuous synthesis of leading and lagging strands.
- 4. Enzymes of DNA replication in prokaryotes and eukaryotes; DNA polymerases, DNA ligase, primase.

UN IT-III

- Structural features of RNA (rRNA, tRNA, mRNA) and polycistronic and monocistronic RNA.
- 2. Transcription: General principle and processes of transcription; initiation, elongation and termination, types of RNA polymerases, inhibitors of RNA synthesis.
- 3. Control of transcription by interaction between RNA polymerases and promoter region, use of alternate sigma factors, controlled termination: Rho dependent and Rho independent.
- 4. Post transcriptional modification, maturation and splicing of RNA transcripts, catalytic 102ml/2011 RNA





UNIT-IV

- 1. Genetic code; nature of genetic code, codon, anticodon, wobble hypothesis.
- 2. Protein synthesis: steps, details of initiation. elongation and termination.
- 3. Inhibitors of protein synthesis: signal hypothesis.
- 4. Post translational modification: covalent modification, phosphorylation, glycosylation, and methylation. Protein targeting.

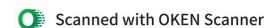
UNIT-V

- 1 Regulation of gene expression: operon concept; regulatory and structural gene. operator, promoter, repressor, induction and repression, positive and negative control.
- 2 Lac-operon, ara-BAD operon, trp operon, attenuation, mechanism of regulation of transcription.
- 3 Regulation of gene expression in eukaryotes: Britton and Davidson's model of regulation involve HCP and NHCP and hormones.
- 4 Transposable elements.

- 1. Genes V bY Benjamin Lea in, Oxford University Press, New York.
- 2. Gene IX, Benjamin Lewin Oxford University Press, New' York.
- 3. Principles of Genetics, Snusiad and Simmons, Fourth Edition, John Wiley and Sons,
- 4. Molecular Cell Biology. Lodish et. al. W. H. Freeman and Company.
- S. Genomes by T.A. Brown, .lohn Wiley and sons (Asia)PTE LTD, New York.
- 6. Principles of Gene Manipulation and Genomics by S.B. Primrose and R. M. Twvman, Seventh edition, Blackwell Publishing, U.K.
- 7. Cell and Molecular Biology concepts and experiments By Gerald Karp, Third edition .John Wiley and sons, Inc., I.I S A
- 8. Chromatin and Gene refutation (2001) Turner Wiley-Blackwell
- 9. An Introduction to Genetic Analysis, Grifiths et.al, W. H. Freeman







MB: 202 IMMUNOLOGY

UNIT-I

- 1. History of immunology, development of immunology as discipline.
- 2. Immune response: mechanism of innate and adaptive immune response.
- 3. Hematopoiesis: development of immune cells. regulation of hematopoiep[sis.
- 4. Structure, composition and types of cells involved in immune response: mononuclear cells, granulocytes. antigen presenting cells, lymphoid cells. Mediators and process of inflammation.

UNIT-II

- 1. Anatomical organization of immune system: primary and secondary lymphoid organs: structure and function.
- 2. Antigens- structure and propenies, factors affecting the immunogenicity, properties of B and T- cell epitopes, haptens, mitogens. superantigen, adjutants.
- 3. Antibody: structure, properties, types and function of antibodies, antigenic determinants on immunoglobulin; isotypes, allotypes, and idiotrpes. Molecular mechanism of antibody diversity and class switching.
- 4. Cell mediated immunity and its mechanism.

UNIT-III

- 1. Major histocompatibility complex: organization of MHC genes, types and function of MHC molecules, antigen presentation, MHC polymorphism, MHC related diseases.
- 2. Complement system: components, activation pathways, regulation of activation pathways and role of complement system in immune response.
- 3. Cytokines: types, structure and functions, cytokines receptors, cytokine regulation of immune receptors.
- 4. Immune response to infectious diseases: viral infection, bacterial infection, protozoan diseases. Helminthes related diseases.





UNIT IV

- 1. Hypersensitivity: type I. II. III and types IV hypersensitivity. Immunodeficiency diseases: primary and secondary immunodeficiency.
- 2 Autoimmunity organ specific autoimmune diseases, mechanism of autoimmune diseases and therapeutic approaches.
- 3. Transplantation immunology: immunologic basis of graft rejection, clinical manifestation of graft rejection and clinical transplantation.
- 4. Cancer immunology: tumor antigen, Immune response to tumor, oncogene and induction, cancer immunotherapy.

UNIT V

- 1. Vaccines: Active and passive immunization, vaccine schedule, whole organism vaccine. subunit vaccine. vaccine, DNA vaccine. recombinant vaccine. subunit vaccines and anti-idiotype vaccine.
- 2. Hybridoma technology: murine monoclonal antibody production, principle of selection, characterization and applications in diagnosis, therapy and basis research.
- 3. Antibody engineering: Chimeric and Humanized monoclonal antibodies.
- 4. Antigen- antibody interaction: acidity and affinity measurements, detection of antigenantibody interaction by precipitation, agglutination, RIA, and ELISA.

Reference Books

- 1. Kuby immunology by Kindt TJ, Golds by RA, Osborne BA, Kuby I: 6th edition. New York. WH Freeman: 2006
- 2. Cellular and Molecular Immunology by Abbas AK, Lichtman AH, Pillar S: Saunders Elsevier; 20(17.
- 3. Immunobiology. The immune system in health and disease by Janes ay CA, Travers P, Walport M, Shlomchik MJ: 6th edition. New York. Garland Science Publishing; 2005.
- 4. Medical Microbiology and immunology by Levinson W, Javvetz F: Lange publication; 2001.
- 5. Roitt's Essential immunology bi Delves PM. Martin SJ, Burton DR, Roitt IM, 11th edition. Blackwell Publishing/Oxford Univ. Press; 2006. July 12/2/2/



MB: 203 MICROBIAL PHYSIOLOGY AND METABOLISM

UNIT-I

- 1. Bioenergetics and metabolism: Basic concepts.
- 2. First and second law of thermodynamics, concept of free energy, entropy and enthalpy.
- 3. High energy phosphate compounds, role of ATP, ATP cycle, structural basis of free energy change during hydrolysis of ATP.
- 4, Biological redox reactions, Biological reducing power and its role in biological system.

UNIT-II

- 1. Carbohydrate metabolism: glycol sis and its regulation, Feeder pathway of glycolysis and carbohydrate homo and heterolactic fermentation, Glycogenesis, Glycogenolysis and regulation, Gluconeogenesis.
- 2 Pentose phosphate pathway, E-D pathway. Kreb s cycle and glyoxalate pathway.
- 3. Electron transport system in Mitochondria. Electron carters and multi enzyme complex I to IV.
- 4. ATP synthesis: substrate level and oxidative phosphorylation and un-couplers, inhibitors of oxidative phosphorylation.

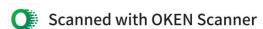
UNIT-III

- 1. Photosynthesis: Oxygenic and an-oxygenic microorganisms, structure of chloroplast, light reaction, photolysis of water and photophosphorvlation. C3 and C4 pathway of carbon fixation.
- 2 Nutritional classification of microorganisms, Energy generation in cyanobacteria, green bacteria, purple sulphur bacteria and chemolithotrops.
- 3. Lipid biosynthesis. biosynthesis of lipids and fatty acids. triglycerol and phospholipids and their regulation
- 4. Lipid Metabolism: Degradation of Lipids, oxidation of unsaturated, saturated, even and odd chain fatty acids, ketone bodies.

UNIT-IV

- 1. Amino acid metabolism. Biosynthetic families of amino acids: Outlines.
- 2. Catabolism of amino acids: Breakdown of amino acids into six common intermediates and urea cycle and relationship with TCA cycle. Outlines.





- 3. Nucleotide metabolism: Biosynthesis of purines and pyrimidines nucleotides by de novo and salvage pathways.
- 4. Degradation of Purines and Pyrimidines nucleotides.

UNIT-V'

- 1. Nitrification, denitrification. Nitrate and ammonia assimilation pathways, Nitrogen cycle,
- 2. Diazotrophs and Biochemistry of nitrogen fixation, Structure of nitrogenase complex.
- 3. Regulation of nitrogenase complex by oxygen and combined nitrogen sources.
- 4, Nitrogens and their regulation.

- 1. Biochemistry by Geoffrey L. Zuba;'. Fourth Edition, Addison- Wesley educational publishers Inc., 2008
- 2. Lehninger Principles of Biochemistry by David L. Nelson and Michael M. Cox. Fifth Edition, W.H. Freeman and Company; 2008.
- -3. Microbial lipids edited by C. Ratledge and SG Wilkinson, second edition, Academic Press; 1988.
- 4. Microbial Physiology by Albert G. Moat and John W. Foster. Third edition, John Wiley and Sons: 2002
- 5. The Physiology and Biochemistry of Prokaryotes by David White. Second Edition.

 Oxford University Press; 2000.





MB: 204 BIOSTATISTICS, COMPUTER APPLICATION & BIOINFORMATICS

UNIT-I

- 1. Definition of statistics and scope of statistics in bio research,
- 2. Types of sampling methods, survey design, organization and graphical representation of data.
- 3. Measures of central tendency
- 4. Measure of dispersion, correlation. Calculation of Karl Pearson's coefficient of correlation. Theory of multiple correction and property.

UNIT-II

- 1. Regression Analysis, linear regression, regression equation
- 2. Hypothesis testing: Types of hypothesis testing: t-test. 2 -Test and F- test.
- 3. Introduction of Design of Experiment (DOCX and factorial design.
- 4. Application of SPSS software.

UNIT-III

- 1. History & development of computer organization of a basic computer application in molecular biology.
- 2. Number system, computer arithmetic & Boolean algebra.
- 3. Type of operating systems, DOS, WINDOWS & L INUX, Introduction to MS Office.
- 4. Basic concept of programming: algorithm. flow charts & introduction to computer languages, basic idea of internet, use of various software in microbiology.

UNIT-IV

- 1. Bioinformatics. An overview, introduction mad scope of bioinformatics.
- 2. Databases: Characteristics, categories and types. Literature database (PubMed, LITD), Disease database (OMIM, Gene Cards, Medline Plus). Information retrival system (Entrez, SRS).
- 3. Sequence Database: EMBL. DDBJ. GenBank, UniGen, PIR. SWISS-PROT and TrEMBL. Structure Database: PDB, CATH, DALI, SCOP.
- 4. Data mining tools: Modelling tools (Rasmol, SPDV, Hyperchem), Data submission tools (Bankit, Sequin. Webin, Sukura. Spin, Autodep).



UNIT-V

- 1. Algorithms: Classification of algorithms. Sequence Comparison algorithms (Dot matrix). Submission metrics algorithms (PAM, BLOSUM). Tools for sequence Alignment (FASTA, BLAST, ORF finding).
- 2. Gene Prediction: Methods. Gene mapping: DNA sequencing, Sequence alignment optimal algorithms I Smith- Waterman algorithm. Needleman Wunsch algorithms. Tools for Genome analysis t COGs, Map Viewer, GEO).
- 3. Phylogenetic analysis. Phylogenetic trees. Methods of phylogenetic evaluation. Prediction tools (Phylip, GenScan, Pfam, Modeler)
- 4. Proteomics: Proteoime analysis, Tools for Protein sequence analysis and proteomics (PSI-BLAST, CD search, CDART), structure analysis (Cn3D, CD search).

- 1. Sampling Techniques, Cochran W.G., Wiley eastern Ltd, New Delhi.
- 2. Fundamentals of statistics, Soon. Gupta and Dasyupta, World Press, Kolkata.
- 3. Statistical methods, Gupta S.P., Sultan chand & Sons.
- 4. Fundamentals of Biostatistics; Irfan Ali Khan and Atrya Khanuiri, 2nd Edition. Ukaaz Publications, Hydrabad.
- 5. Bioinformatics: Databases, Tools and Algorithms, by Orpita Bosu, Simminder Kaur Thukral. OXFORD University Press.
- 6. Bioinformatics: Sequence and Genome Analysis by D.W. Mount, second edition Cold Spring Harbor Laboratory Press
- 7. Bioinformatics : Methods and Application by S.C. Rastoui. N. Mendira, P. Rastoei. Third edition . PI-II Learning Private Limited
- 8. Introduction to Bioinformatics by Teresa. K. Attwood and David .1. Parry- Smith, Low Price edition, Pearson Education



205: LAB COURSE-I (MICROBIAL GENETICS AND MOLECULAR BIOLOGY & IMMUNOLOGY)

- 1. To induce mutation by UV radiations and to exhibit DNA repair by photo reactivation.
- 2. To isolate and produce UV induced auxotrophic mutants by replica plating method.
- 3. Demonstration of genetic recombination in bacteria by conjugation.
- 4. To perform Ames test for detecting carcinogen or mutagen.
- 5. Quantification of DNA lay DPA method.
- 6. Quantification of RNA by Orsinol method
- 7. To check piu4ty and quantity of DNA by Spectrophotometeric method.
- 8. To isolate genomic DNA from Grain positive and Gram Negative bacteria.
- 9. To isolate total RNA and in RNA thorn bacteria
- 10. To perform SDS-PAGE for separation of proteins in given sample.
- 11. To prepare soluble antigen by different methods.
- 12. To demonstrate various routes of immunization in mice.
- 13. To prepare serum and plasma from blood.
- 14. To precipitate immunoglobulins by ammonium sulphate method and to determine total protein contents.
- 1.5. To determine Blood group and Rh factor by slide agglutination test
- 16. To determine Total Leukocyte Count (TLC) for given blood sample
- 17. To determine Differential Leukocyte Count (DLC) for given blood sample using Leishman's stain.
- 18. To perform widal agglutination test (slide and tube) for diagnosis of typhoid.
- 19. To perform Ouchterlony double diffusion test for detection of antigen and antibody reaction and to demonstrate relationship between antigens.
- 20. To perform Redial immuno-diffusion test for detection of antigen and antibody reaction and for quantification of antigens.
- 21. TU perform immune-electrophoresis tor separation or antigens and for detection of antigen and antibody reaction
- 22. To perform Rocket immuno-electrophoresis for detection of antigen and antibody reaction
- 23 To perform ELISA for assay of antibodies in serum sample against given antigen

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206: Lab course - II (Microbial Physiology and Biostatistics, Computer **Application and Bioinformatics**)

- 1. To study catalase activity of given microbial culture.
- 2. To study oxidase activity of given microbial culture.
- 3. To study ability of microorganisms to hydrolyse casein
- 4. To demonstrate phenylalanine deaminase activity of given bacterial culture.
- 5. To demonstrate L-lysine decarboxylase activity of bacterial culture.
- 6. To demonstrate carbohydrate metabolism (oxidation and fomentation of Glucose) in microorganisms
- 7. To demonstrate Fat hydrolysis (lipase activity) by bacteria
- 8. To study ability of microorganisms to hydrolyze gelatin
- 9. To demonstrate degradation of sulphur containing amino acids by bacteria
- 10. Representation of statistical data by 1. Histogram 2. 0 give carves 3. Pie diagrams
- 11. Collection of data using different sampling methods
- 12. Determination of Averages or Central tendencies (Mean, Mode, Median)
- 13. Determination of measures of dispersion (Mean, deviation, Standard deviation and Coefficient of variation. Quartile deviation)
- 14. Application of Tests of significance (Chi-Square test, student t-test, Standard error)
- 15. Applications of computers in biology using MS-office (MS-Word, Excel, Power point)
- 16. To access scientific data from Literature data bases (PUBMED. LITDB. Medline)
- 17. To access nucleic acid databases for retrieval of gene sequence.
- 18. To access protein databases for retrieval of amino acid sequence of target protein.
- 19. To perform pair wise sequence alignment using Dot matrix.
- 20. To perform multiple sequence alignment using BLAST.

- 21. To perform multiple sequence alignment using CLUSTAL-W and to find conserved sequences using JAL view.
- 22 To prepare Phylogenetic tree and Cladogram using CLUSTAL-W
- 23 3D protein structure prediction and structure refinement using Swiss-PDB viewer





MB: 301 MEDICAL AND PHARMACEUTICAL MICROBIOLOGY

UNIT-I

- 1. Infection: types of infection, sources of infection, reservoirs and vehicles of infection, predisposing factors.
- 2. Host-parasite relationship governing the infection and establishment of disease, factors affecting virulence.
- 3. Normal micro flora of human body: normal flora of skin, respiratory, gastrointestinal, genital tract, role of resident flora, concept of probiotics.
- 4. Mode of spread of infection; Respiratory, skin, wound & bum infection, venereal infections, alimentary tract infection, blood born infection and nosocomial infection.

UNIT-II

- 1. Infections caused by Gram positive cocci and Grain negative cocci: Source of infection, Pathogenicity, Epidemiology & Lab diagnosis of *Staphylococcus*, *Streptoc-occu*: and *Neisseria* (meningitis, gonorrhea)
- 2. Infections caused by Gram negative bacteria of family Enterobacteriaceae: Source of infection, Pathogenicity. Epidemiology & Lab diagnosis of *E. coli, Klebsiella, Proteus, Pseudomonas, Shigella dysenieriae* and *Salmonella typhi*.
- 3. Injection caused by Gram Positive bacilli: Source of infection, Pathogenicity, Epidemiology & Lab diagnosis of *Corynebacterium diphtheriae*. *Bacilltls anthracis*, *t"lostrodiuiii tetani*. *Vibrio cholerae*.
- 4. Disease caused by acid-fast bacteria and intracellular bacteria: Source of infection, Pathogenicity, Epidemiology & Lab diagnosis of *Mycobacterium tuberculosis*, *Mycobacterium leprae*, *Rickettsia* and *Chlamydia*.

UNIT-III

Morphology, pathogenesis, immune response, diagnosis and prevention of

- 1. Pox viruses (Variola, Vaccinia, Small pox) Herpes Simplex type I and type II, Picorna viruses (Enteroviruses and Polioviruses).
- 2. Paramyxo viruses (Rubula virus and Parainfluenza viruses), Orthomyxoviruses (Measles
- & Mumps viruses).
- 3. Hepatitis viruses (Type A, B, C, D, E), Arboviruses (Alphavirus and Flaviviruses), Rhabdo viruses (Rabies virus).
- 4. Oncogenic viruses, HIV virus.

UNIT-IV

- 1. Important protozoal diseases: Route of entry, Life Cycles, Immunity, disease produced, diagnosis & prophylaxis of *Plasmodium yivax*, *P. falciparum*, *P. malariae* (Malaria), *Entamoeba histolytica* & *Entamoeba coli* (amoebiasis),
- 2, Route of entry, Life Cycles, Immunity, disease produced diagnosis & prophylaxis of *Leishmania, Trypanosomo* and *Toxoplasma*.
- 3. Fungal infections: description & classification of pathogenic fungi, Infection caused by

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dermatophytes (Microsporum, Trichophyton & Epidermatophyton)

4. Definition, Causative agent, Source of infection, Epidemiology. Symptomatology' & Diagnosis of Candidiasis, Aspergillosis and Histoplasmosis.

UNIT-V

- 1. Antimicrobial agents: History, Antibiotics, Antifungal and Antiviral (common drugs, their spectrum and mode of action)
- 2. Methodologies for testing of antibacterial, antifungal, and antiviral drugs (In vivo and In vitro infectivity models), mechanism drug resistance.
- 3. Preclinical development: Safety profile of drugs (Pyrogenecity, Toxicity —hepato-nephro,cardio and neurotoxicity), Toxicological evaluation of drug (LD50, Acute, subacute and chronic toxicity), Mutagenecity (Ames test, micronucleus test) and Carcinogenicity.
- 4. Clinical studies: Phase I, phase II, phase III and phase IV of clinical trials —Objectives. Conduct of trials, Outcome of trials.

Reference Books

- 1. Textbook of Microbiology by Ananthnarayanan and Paniker's, eighth edition, Universities
- 2. Brock Biology of Microorganisms, M.T., Madigan, J.M. Martinho and J. Parker, Ninth edition, Prentice Hall. Upper Saddle River, NJ.
- 3. Microbiology: An introduction, G.J. Tortora B, R. Funke and C.L. Funke.
- 4. Virology, Renato Dulbeceo and Harold S. Ginsberg, Fourth edition J.B. Lippincott Company, USA
- 5. An Introduction to viruses, S. B. Biswas and Amita Biswas. Forth edition. Vikas Publishing House PVT LTD new Delhi.
- 6. Medical h4icrobiology; Jawetz, Melnick, & Adelberg's, Fifhi edition, MacGrow Hills
- 7. Medical Bacteriology, Medical Mycology and AIDS: N.C.Dey, T.K. Dey and D. Sinha New Central Book Agency (P) Ltd.
- 8. Principles of Therapeutics, Bum J. H., Blackwell Scientific Pub. O. Ltd. Oxford.
- 9. Principles of Drug Action, The Basis of Pharmacology, Goldstein A., Aronow L., and Kabnan
- S. It., Harper international edition New York.
- 10. Mannfred A. Holliger, (2008), Introduction to pharmacology. 3rd Ed., CRC Press



MB: 302 RECOMBINANT DNA TECHNOLOGIES

UNIT-I

- 1. Enzymes used in DNA technology: Restriction and modification enzymes. nucleases, polymerases, ligase kinases and phosphatases. Linkers and adapters.
- 2.. Cloning vectors. Plasmids, Phages Lamda and M 13) Phagmids, Cosmids and Expression vectors.
- 3. Cloning vectors for Yeast (shuttle vector and YAC and cloning vector for animal cells: SV 40. Vaccinia and Retroviruses.
- 4. Cloning techniques: DNA isolation (Bacteria. Fungi. Plant and animal), Insert preparation, Ligation, Transformation methods (chemical methods, Electroporation and microinjection). Transfection.

UNIT-II

- 1. Genomic and cDNA library.
- 2. Screening of clones from libraries: Expression based screening, Interaction based screening.
- 3. Gene Expression: Expression vectors, factors affecting expression of cloned gene in *E.coli*
- 4. Mutagenesis: Site directed mutagenesis, Transposon mutagenesis.

UNIT-III

- 1. DNA Sequencing: Sanders method. Maxam Gilbert method Thermo cycle sequencing and Pyrosequencing.
- 2. Principles of hybridization and hybridization based techniques: Colony, plaque, in-situ hybridization, Southern, Northern, Western blotting.
- 3. Oligonucleotide synthesis, Restriction mapping, S1 nuclease and RNase mapping
- 4. Polymerase Chain Reaction (PCR): Principle, Types and variants of PCR (Touch-Down PCR, Hot start PCR, Inverse PCR, RT-PCR, multiplex PCR, nested PCR), Real time PCR. 12/8/14/



UNIT IY

- Molecular tying: RFLP (Ribotyping, IS based), RAPD, AFLP, VNTR, SNP, Whole genome sequence: GIS
- Promoter characterization: promoter analysis through reporter genes, electrophorotic mobility, shift assay, DNA foot-printing & DNA fingerprinting.
- 3. Transgenic animals: Strategies and methods.
- Construction of knockout mutants.

UNITY

- Applications of Recombinant DNA Technology in Medicine, Molecular diagnostics, recombinant and DNA vaccines.
- 2. Gene therapy: somatic and germ line gene therapy.
- 3. Applications of Recombinant DNA Technology in Agriculture and Industry.
- Biosafety & ethical considerations for GMOs.

- 1. Molecular Biotechnology. Glick BR. Pasteriiak JJ. ASM Press Washington D.C.
- 2. Principles of Gene Manipulation. Old and Primrose. Blackwell Scientific Publication.
- 3. Gene Cloning. T. A. Brown. Blackwell Publishing.
- Molecular cloning- A Labora tory manual. Sambrook. Fritseli and Miniatis. Cold Spring Harber Laboratory Press.
- Molecular Biotechnology " 2md Edition by S.B. Primrose. Blackwell Scientific Publishers. Oxford.
- 6. Genetic Engineering and Introduction to Gene Analysis and Exploitation in Eukaryotes by S.M. Kingsnan and A.J. Kinysman. Blackwell Scientific Publications, Oxford.
- 7.PCR Technology Principles and Applications for DNA Amplification by Henry A. Erlich (Ed.), Stockton Press.
- 8. Genes and Genomes: A Chanting Perspective, Maxime Slager and Paul Berg.
 University Science Books, Mill Valley, CA, 1991



MB: 303 FERMENTATION AND MICROBIAL TECHNOLGOY

UNIT-I

- 1. Industrially important strains of bacteria, fungi, and actinomycetes . Novel microbes tor future industry.
- 2. Isolation and screening of tire industrially important strain from diverse ecosystem.
- 3. Method of strain improvement, mutagenesis, strain breeding by protoplast fusion. sexual and para sexual recombination.
- 4. Fermentation technology: principles of fermentation. Fermenter and bioreactors: monitoring and control of parameters, designing, operation and application.

UNIT-II

- 1. Downstream processing: filtration of fermentation broths recover of biological products by distillation, superficial fluid extraction.
- 2. Detection, analysis and quality control of fermentation products and raw materials.
- 3. Industrial production of alcohols: vinegar, wine and alcohol.
- 4. Industrial production of solvents-glycerol, acetone and Butanol.

UNIT-III

- I. Industrial production of citric acid and glutamic acid.
- 2. Microbial production of enzyme of industrial important: amylase and proteases.
- 3. Methods of whole cell immobilization, enzyme immobilization and application.
- 4. Industrial production of antibiotics, penicillin and streptomycin.

UNIT IV

- 1. Hygiene and safety in fermentation industries.
- 2. Microbial production of Vitamin B2 and B12.
- 3. Microbial production of Interferon, Insulin, flavours and fragrances.
- 4. Bioelectronics: Biochips and biosensors.

UNIT-V

- 1. Microbial production of vaccines.
- 2. Microbial production of polymers . Dextran and xanthan.
- 3. Microbial transformations: Steroid biotransformation
- 4. Intellectual property rights (IPR) and protection (IPP)





Reference Books:

- 1. Principles of Fermentation Technology by Stanbury, P,F., Whitaker A. and Hall.
- 1995. Butterworth Heinemann
- 2. Biotechnology A Text Book of Industrial Microbiology by Cruger.
- 3. Fermentation Biotechnology. Industrial Perspectives by Chand.
- 4. Biochemical Engineerings Fundamentals b Bailey and Ollis, Tata McGraw Hill. N.Y.
- 5. Biotechnology, Volume 3. Edited by H. J. Rehin and G. Reed, Verlag Cheinic. 1983.





MB: 304 ENVIRONMENTAL MICROBIOLOGY

UNIT-I

- 1. Microbial ecology, basic concepts, types and microbial habitats, factors affecting microbial population.
- 2 Microbial interactions: competition, commensalism, parasitism, mutualism, synergism.
- 3 Population ecology: characteristics of population, population growth curves (R & K selection) population regulation.
- 4 Conservation and management of microbial diversity: biodeterioration and biodegradation.

UNIT-II

- 1. Microbiology of air: microorganism of air enumeration of air micro flora.
- 2. Significance of air micro flora.
- 3. Brief account of air borne transmission of bacteria. Fungi, pollens and viruses.
- 4. .Air borne diseases and their prevention.

UNIT-III

- 1. Soil microbiology: microflora of soil: soil microorganisms associated with plants: rhizosphere. mycorrhizae.
- 2. Role of microorganisms in organic matter decomposition (cellulose, hemi cellulose, lignin).
- 3. Bioleaching: introduction, application of bacterial leaching techniques, properties of bioleaching.
- 4. Microbial degradation of xenobiotics, petroleum and oil spills in environmental decay behaviors and degradative plasmid.

UNIT-IV

- I. Water Microbiology. aquatic microorganisms. fresh water and sea water microflora. Microorganisms and water quality, water pollution.
- 2. Water purity test and indicator organisms, method used in environmental studies—BOD, COD, DO.
- 3. Common water born disease and their control measure.
- 4. Water purification flocculation, chlorination and purification

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UNIT-V

- 1. Microbiology of waste water and effluent treatments, aerobic process: primary, secondary and tertiary treatment trickle filter ,oxidation ponds and stabilization ponds , principle of aerobic digestion.
- 2. Bioremediation of contaminations.
- 3. Extremophiles —acidophilic, alkalophilic, thermophilic microbes with adaptation and application in ecosystem.
- 4. Microbial biofilms, physiology, morphology, biochemistry of microbial biofilms, mechanism of microbial adherence, beneficial and harmful role of biofilms.

- 1. Microbial Ecology: Fundamentals and applications, Ronal's M, Atlas, fourth edition, An imprint of Addison Wesley Loniziran. Inc. California
- 2. Environmental chemistry, A.K. De, Wiley Eastern Ltd., New Delhi
- 3. Environmental Science, Physical Principles and applications: Egbert Boeker et. al.
- 4. Comprehensive Biotechnology. vol.4, M.moo-young (Ed-in-chief. Pergmon Press. Oxford.
- Wastewater Treatment for Pollution Control By Soli I Arceivala, Second Edition, Tata McGraw- Hill Publishing Company Limited.
- 6. Environmental Biotechnology Theorr and Application by Gareth M. Evans and Judith
- C. Furlong. .Iohn Wiley and Sons, LTD, U.S.A.
- 7 Ecology and Environment by P.D. Sharma, Psastogi Publications, New' Delhi, In5(a
- 8. Environmental Sciences earth as a living planet by Daniel K. Botkin and Edward A. Keller, Third edition, John Wiley and Sons, LTD, U.S.A.



MB: 305 1.ab course 1 (MEDICAL AND PHARMACEUTICAL MICROBIOLOGY AND RECOMBINANT DNA TECHNOLOGIES)

- 1. To prepare various basic. Selective, enrichment and enriched media used for isolation of medically important bacteria from clinical samples.
- 2. To perform various biochemical tests (IMVIC, oxidase, catalase, urea utilization test, sugar utilization and H2S production on TSI agar slant used for identification of medically important bacteria.
- 3 To perform sugar fermentation tests used for identification of medically important bacteria.
- 4. Preparation of transport media for different clinical samples.
- 5. Demonstration normal microbial flora of skin, mouth and throat
- 6. Isolation and identification of *Staphylococcal* species using suitable media, staining techniques and biochemical tests.
- 7. Isolation and identification of *Staphylococcal* species using suitable media, staining techniques and biochemical tests.
- 8. Identification of bacterial specie.* belonging to Enterobacteriaceae family using suitable biochemical tests (*E. coli, Proteus, Pseudomonas* and *Klebsiella*)
- 9. Isolation and identification of enteric lever causing bacteria (*Salmonella typhi*) using suitable media and biochemical tests.
- 10. Isolation and identification of bacillus species using suitable media, staining techniques and biochemical tests
- 11. Microbiological analysis of urine specimens,
- 12. Microbiological analysis of sputum specimens
- 13. Isolation dermatophytes and their identification based on colony morphology and microscopic characteristics.
- 14. 'No determine antibiotic sensitivity for Gram negative and Gram positive bacteria by disc diffusion method
- 15. To determine Minimal Inhibitory Concentration IMVIC) and Minimal Bactericidal concentration of an antibiotic for test bacteria.



- 16. To study antibiotic resistance in bacteria
- 17. Preparation of LB broth, LB Agar with antibiotic for culture and maintenance of Host *E coli* and *E.coli* with plasmid vector
- 18. Isolation of plasmid DNA (or plasmid vector DNA)
- 19. Restriction digestion of given DNA with suitable restriction enzymes.
- 20. Ligation of insert (gene) and vector DNA
- 21. Preparation of competent cells
- 22 Transformation of host E. coli with recombinant DNA and selection of recombinants.
- 23 To perform PCR for amplification of target DNA segment (or gene)

MB: 306 Lab course II (FERMENTATION AND MICROBIAL TECHNOLGOY & ENVIRONMENTAL MICROBIOLOGY)

- 1. Determination of thermal death point (TDP) of an Organism
- 2. Determination of thermal death time (TDT) of an Organism
- 3. Isolation of amylase producing microorganisms form soil
- 4. Isolation of cellulase and pectinase producing microorganisms from vegetable and fruit
- 5. Isolation of lipase producing microorganisms from butter.
- 6. To isolate antibiotic producing microorganisms form soil
- 7. To isolate *Penicillium* species producing penicillin.
- 8. Production of penicillin and to evaluate ii activity
- 9. To demonstrate handling and sterilization of Fermentor
- 10. Production of wine from grapes
- 11. To demonstrate strain improvement of industrially important bacteria or yeast by mutagenesis and selection of improved strains.
- 12. Determination of Total Dissolve Solids (TDS) ot given water sample
- 13. Determination of chemical oxygen demand (COD) of given water sample
- 14. Determination of Dissolved oxygen (DO) of given water sample
- 15. Determination of BOD of given water sample
- Id. Determination of total bacterial population by standard plate count technique
- 17. Determination of the most probable number (MPN) of coliform bacteria in water
- 18. Microbiological analysis of water by membrane filter method
- 19. Microbiological analysis of air for presence of pathogenic microorganisms in air
- 20. Microbiolot'ica1 analysis of water for presence of pathogenic microorganisms



MB: 401 AGRICULTURE MICROBIOLOGY

UNIT I

- 1. Microorganisms of soil
- 2. Rhizosphere and phyllosphere microflora
- 3, Brief account of Microbial interactions. antagonism, symbiosis, mutualisim, commensalisms, synergism and parasitism.
- 4. Nutrient cycle: Carbon cycle, nitrogen cycle, phosphorous cycle and sulphur cycle.

UNIT II

- 1. Role of enzymes and toxins in pathogenesis.
- 2. Fungal diseases of plants: Rusts of wheat, linseeds; late blight of potato: red rot of sugarcane.
- 3. Bacterial diseases o1 plants: Citrus canker. blight of rice
- 4. Viral diseases of plants: Leaf curl of Papaya, vein clearing of lady's finger

UNIT III

- 1 Physical and chemical control of plant diseases
- 2. Bacterial control of insect pests Bacillus thuringinesis as bacterial insecticide
- 3. Viral control of insect pests Nuclear polyhedrosis viruses (NPV) and cytoplasmic polyhedrosis viruses (CPV)
- 4. Fungal control of insect pests: Entomopathogenic fungi. Metarhizium anisopliae. Beauveria bassiana, verticillium lecani, Hirsutella thompsonii.

UNIT IV

- 1. Storage fungi: Categories of storage fungi. conditions during storage in relation to damage of seeds, harmful effects
- 2. Mycotoxins and their effect on human being.
- 3. General idea about quarantine
- 4. Production of biogas and alcohol from agricultural wastes





UNIT V

- 1. Biofertilizers: Types, production and application
- 2. Mycorryzae: Types and their application in agriculture and forestry.
- 4. Reclamation of waste agricultural land by microorganisms

- i. Soil Microbiology by Prof. N.S. Subba Rao, Fourth edition, Oxford and IBH Publishing CO. PVT., LTD., New Delhi
- 2. Introduction to soil microbiology. Alexander M. (1977) John Wiley & Sons. Inc., New York.
- 3. Modem Soil Microbiology, Dirk .I, Elas V, '1 revors .IT, Wellington, EMH (1997) Marcel Dekker INC, New York,



MB: 402 FOOD MICROBIOLOGY

UNIT I

- 1. Microorganisms important in food microbiology: molds, yeast and bacteria general characteristics, classification and importance.
- 2. Principles of food preservation, preservation by use of high temperature, low temperature, drying and desiccation.
- 3. Chemical preservatives and additives.
- 4. Preservation by radiation.
- 1. Factors influencing microbial growth in food. Extrinsic and intrinsic factors.
- 2. Microbial spoilage of food. Chemical changes caused by the microorganisms during spoilage.
- 3. Spoilage of fish meat, poultry. Eggs, fruits and vegetables.
- 4. Detection of spoilage and characterization.

UNIT III

- 1. Classification of food borne diseases.
- 2. Food borne infections: *Brucella, Bacilllus cereus, Clostridium perfringens, Yersinia enterocolitica and Escherchia, Salmonella* sps.
- 3. Food intoxication: Staphylococci intoxication, Clostridial poisoning (Clostridium botulinium).
- 4. Food adulteration and prevailing food standards in India.

UNIT IV

- 1. Microbiology of Milk: Sources of microorganisms in milk and types of microorganisms in milk.
- 2. Microbiological examination of milk (standard plate count, direct microscopic count, reductase, and phosphatase test).
- 3. Dehydration and pasteurization of milk.
- 4. Dairy products from microorganisms: Butter, yoghurt and cheese.

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UNIT V

- 1. Microorganisms as source of food: Single Cell Protein (SCP)
- 2. Mushrooms and food value of mushrooms
- 3. Food conversions: Lactic acid conversions, soyabean conversions and Bakery
- 4. Microbiological estimation of food: Sample collection, preparation and analysis

- 1. Food science By Norman N. Potler, Joseph H. Hotchkiss. Fourth edition, CBS Publishers and Distributors, New Delhi
- 2. Food Microbiology , by William C. Frazier and Dennis C. Westhoff, Fourth edition, Tata McGraw-Hill Publishing Company Limited, New Delhi
- 3. Modern Food Microbiology by .lames M. Jay, Fourth Edition, CBS Publishers and Distributors, New Delhi.

MB: 403 Lab course (FOOD MICROBIOLOGY AND AGRICULTURE MICROBIOLOGY)

- 1. Detection of adulterants in spices, pulses, sugar tea.
- 2. Detection of adulterants in milk and milk products
- 3. Detection of arsenic by microbiological methods
- 4. detection of nicotinic acid by bioassay
- 5. Detection of number of bacteria in milk by SPC
- 6. Determination of quality of mill sample by in ethylene blue rededicates test.
- 7. To demonstrate i ole of least in bread-waking
- 8. Isolation of spoilage microorganisms from food
- 9. Isolation of pathogenic microorganisms from food
- 1. 0. To study vital diseases in plants
- 11. To study bacterial and fungal diseases in plants
- 12. Isolation of rhizobia from root nodules of leguminous plants
- 13. Testing of nodulation ability of rhizobia.
- 14. Inoculation of seeds with rhizoliia.
- 1.5. To study pesticidal activity of Bacillus thuringiensis
- IG. Isolation of VAM spores from soil
- 17. Isolation of azotobacter species from soil
- 18. Isolation of microorganisms from rhizosphere.

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