Syllabus

FIRST SEMESTER

MB101 - Microbial Biochemistry

UNIT I

Carbohydrates: Classification, function and properties of mono, di, oligo, homo and heteropolysaccharides. Properties and functions of glycolipid, glycoprotein, chemical structure and properties of starch, cellulose, hemicellulose and glycogen, Lipids: Classification and properties of saturated and unsaturated fatty acids, complex lipids and sterols in microbial system. Amino acids and proteins**:** Classification of amino acids, Peptide bonds, classification and functions of proteins. Protein sequencing. Nucleic acids: purines and pyrimidines, Phosphodiester linkage, Structure of DNA, Higher order structure of DNA, chromatin structure, nucleosome, histones, RNA- types, structure and functions.

UNIT II

Cell membrane and transport**:** Membrane proteins, lipids. Fluid mosaic model, membrane fluidity, asymmetry, lipid raft, functions of membrane proteins and lipids. Regulation of transport: porins, facilitated diffusion, porter molecules; Facilitated transport: symport, antiport, uniport, anion porter, glucose porter; Active transport: proton pumps; Na+ K+ pumps, Ca2+ pumps; Ionic channels: general characteristics of ionic channels. Cell signalling: Prokaryotic cell to cell signaling - quorum sensing, mechanism of quorum sensing.

UNIT III

Energy production in bacteria – energy and ATP, aerobic and anaerobic respiration, glycolysis, tricarboxylic acid cycle, electron transport and oxidative phosphorylation, phosphoketolase pathway, pentose phosphate pathway, gluconeogenesis and glyoxylate cycle.

UNIT IV

Enzyme-Classification and nomenclature, Active site, apoenzyme, holoenzyme, prosthetic group, co enzymes and its functions. Mechanism of enzyme action, activation energy. Factors affecting the velocity of enzyme action, Michaelis Menton kinetics- derivation of MM equation, Km value determination and its significance, Vmax and its significance, LB plot and its application, turn over number. Expression of enzyme activity, enzyme specificity. Enzyme inhibition, enzyme regulation, allosteric regulation. Isoenzymes.

UNIT V

Photosynthetic bacteria and cyanobacteria- pigments of photosynthetic apparatus, mechanism of photosynthesis in bacteria.

REFERENCES:-

1. Berg,J.M., Stryer,L(2002) *Biochemistry* W.H Freeman&Company
2. Nelson,D.L.,Cox,M(2008) *Lehninger's Principles of Biochemistry* Mac Millan
3. Voet,D and Voet, J.G (2010) *Biochemistry* 4th edition Wiley
4. Jain,J.L(2005)*Fundamentals of Biochemistry* 6 th edition S.Chand&Co
5. Deb,A.C(2001*) Fundamentals of Biochemistry* New Central Book Agency(P) Ltd
6. Pelczar,M.J., Chan,E.C.S and Kraig(1977) *Microbiology* Mc Graw-Hill
7. Talaro, K.P. ,and Talaro A(2004) *Foundations of Microbiology* 5 th edition Mc Graw-Hill
8. Aneja, K.R., Jain ,P. and Aneja, R(2008)*Text book of Basic and Applied Microbiology* New Age International

MB102 - Biophysics, Instrumentation And Biostatistics

UNIT I

Laws of conservation of energy-first and second laws and their relevance in the biological system, entropy, enthalpy, thermodynamic equilibrium, redox potential, Gibb's free energy, bioenergetics –endothermic and exothermic reactions of biological systems, energy change in the biological reactions. Electrical properties of biological compartments. Electricity as a potential signal, electrochemical gradients, membrane potential, ATP synthesis, chemiosmotic hypothesis.

UNIT II

Protein structure-primary, secondary, tertiary and quaternary strucutres, forces stabilizing, denaturation kinetics, torsion angle, protein – ligand interactions, Ramachandran plot. Nucleic acids- DNA structure and polymorphism. DNA supercoiling. DNA-protein interaction, RNA-protein interaction.

UNIT III

Microscopy, Principles of microscopy, various types of microscopy – simple microscope, phase contrast microscope, fluorescent microscope, electron microscope, polarization, confocal and interference microscopy, CCD camera, Introduction to Atomic force microscopy. Basic principles and working of instruments, pH meter, spectrophotometer (UV and visible), Beer-Lambert's law, flame photometry, colorimeter. Brief account of densitometry, fluorimetry, manometry, atomic absorption spectroscopy, IR, NMR, X – ray crystallography, flow cytometry and GM counter.

UNIT IV

Centrifugation-Principles of sedimentation technique. Principle, procedure and application of ultra centrifugation, differential centrifugation and density gradient centrifugation. Principle, Instrument Design, types of Chromatography. Principles and procedure of paper chromatography, thin layer chromatography, column chromatography, ion- exchange chromatography, affinity chromatography and gel filtration, GLC, HPLC, FPLC, LC-MS. Electrophoresis-Principles of electrophoresis and applications – paper electrophoresis, gel electrophoresis (native, SDS).

UNIT V

Introduction, scope and concept of sampling – representative sampling and sampling size. Data presentation – graphics, tables, histograms and pi – diagrams. Frequency, distribution, measures of central tendency (mean, median, mode, quartile, decile and percentile). Measures of dispersion, mean deviation and standard deviation. Correlation and regression, scatter diagram, coefficient of correlation, rank correlation, lines of regression. Probability. Basic concepts related to probability theory, classical probability and probability distributions. Introduction and simple properties of binomial, normal and skewed distribution

and their applications in biology. Tests of hypotheses- Some basic concepts, errors in hypotheses testing, critical region, students t – test for the significance of population mean, chi square test for population variance, F- test for the equality of two population variance. Analysis of variance – one way and two way analysis.

REFERENCES: -

1. Martin, R.B. (1964) Introduction to Biophysical Chemistry. Mc Graw Hill
2. Banerjee,P.K. (2008) Introduction to Biophysics .S.Chand & Co
3. A text of Biophysics , R.N Roy.
4. Nelson,D.L.,Cox,M(2008) Lehninger's Principles of Biochemistry Mac Millan .
5. Voet,D and Voet, J.G (2010) Biochemistry 4th edition Wiley
6. Potter, G.W.H. and Potter, G.W.(1994)Analysis of biological molecules : An introduction to principles, instrumentation and techniques. Springer publication
7. Chatwal, G.R., Anand, S.K.(2011) Instrumental Methods of Chemical Analysis . Himalaya Publishing House
8. Watson,J.D. et al.(2014) Molecular Biology of the Gene 7th edition. Pearson publication
9. Nair, A.J. (2007) Principles of Biotechnology . Laxmi Publication (P) Ltd
10. Kumar,H.D., Gupta B.R., Engeldrum, D.(2000)Textbook of Biotechnology. East-West Press
11. Pelczar,M.J.(1993) Microbiology : Concepts and Application. Mc Graw Hill Publications
12. Kenney, J.F. and Keeping,E.S. (1951) Mathematics of Statistics 2nd edition. D Van Nostrand Company
13. Athel Cornish-Bowden (2000) Basic Mathematics for Biochemists 2nd edition. Oxford Press
14. Norman T.J.Bailey (1995) Statistical Methods in Biology 3rd edition. Cambridge University Press
15. Rao,P.S.S.Sundar and Richard,J.(2006) Introduction to Biostatistics and Research Methods 5th edition PHI Learning Pvt.Ltd.

MB103 - Cell and Molecular Biology and Bioinformatics

UNIT I

Cell cycle- different stages, check points, MPF, cyclins and cyclin dependant protein kinases, regulation of cell cycle, Role of Rb & p53, Cell cycle inhibitors, Cell death and cancer: Apoptosis and necrosis, apoptotic pathways, theories on apoptosis, etiology of cancer, mutagens, oncogenic viruses, types of tumor, induction of cancer, properties of cancer cells, oncogenes, oncogene and signal transduction, tumor suppressors.

UNIT II

DNA Replication – Process of DNA replication and models of DNA replication, Initiation of DNA replication, Unwinding of DNA, Elongation, Role of Topoisomerase, Gyrase, SSB, Helicase, Ligase and Primasome. DNA polymerases in eukaryotes and prokaryotes, Klenow fragment, Okazaki fragments, Process at DNA replication fork, Assembly of lagging strand fragments, termination of replication, modes of replication, theta, rolling circle, d-loop replication, Inhibition of replication.

UNIT III

Transcription - RNA polymerases in prokaryotes and eukaryotes, Transcription signals, Promoters and Enhancers, Initiation and Elongation of RNA synthesis, Rho dependent and Rho independent termination, Transcription factors in Eukaryotes, Prokaryotic and Eukaryotic Transcription, post transcriptional modifications, Splicing-Spliceosome, lariat structure, Group 1, II and III Introns, Ribozyme, RNase P, RNAse III, RNAse H. Trans-splicing, alternate splicing, RNA Editing, Guide RNA, inhibitors of transcription.

UNIT IV

Translation- Stages in translation, genetic code, wobble hypothesis, eukaryotic and prokaryotic ribosomes, m-RNAs, t-RNAs, aminoacyl t-RNA synthetases, 30S preinitiation complex, 70S initiation complex, peptidyl transferase, elongation, prokaryotic and eukaryotic translation, inhibition of translation. Post translational modifications. Regulation of gene expression in prokaryotes and eukaryotes, operon - inducible and repressible operon, positive and negative regulation, Lac, Trp, Ara operon, catabolite repression, Attenuation. RNA interference, Antisense RNA, SiRNA, MicroRNA, Ribozwitches and their applications.

UNIT V

Introduction to bioinformatics and Data Mining, Biological databases and search tools, DNA and RNA sequence databases, genomic databases, protein sequence databases, structural databases, derived and specialized databases, Sequence analysis, pairwise and multiple

alignments, sequence analysis softwares, Phylogenetic analysis- methods, Protein structure prediction, structural alignment methods, homology modeling and molecular docking.

REFERENCES:-

1. Benjamin Lewin (2013) *Genes* IX . Jones and Bartlett publishers
2. Watson,J.D., Hopkins,N .H ., Roberts, J.W., Steitz,J.A and Weiner,A.M(1987). *Molecular Biology of the Gene* . Benjamin-Cummings, Menlo Park California
3. Gerald Karp (2014)*Cell Biology* 7Th edition. Wiley publishers
4. Daniel L Hartl & Elizabeth W.Jones(2011) *GENETICS- Analysis of genes and Genomes* 8th edition, Jones and Bartlett publication
5. Snustard and Simmons. *Principles of Genetics* – Wiley plus
6. Freifelder,D.,Stanley ,R.(1994)*Molecular Biology and Microbial Genetics* .J and B publication
7. Maloy,S.R.,Cronan,J.E.,Freifelder,D(1994) *Microbial Genetics* 2nd edition J and B publication
8. Dale, J.W(2004)*Molecular Genetics of Bacteria* 5th edition.Wiley publishers
9. Larry ,S.,Henkin,T.M., Peters,J.E.and Wendy,C(2012) *Molecular Genetics of Bacteria* 4th edition.ASM Press
10. Friedberg , C., Graham, C., Wolfram, S(2009) . *DNA repair and mutagenesis* 2nd edition. ASM Press
11. White ,R.,Downs,T(2007) *How computers work* 9th edition Pearson publishers
12. Kothekar,V(2004)*Introduction to Bioinformatics* 1st edition Dhruv publication
13. Baxevaris,A.D. *Bioinformatics* B.F Publication
14. Higgins ,D.,Taylor,W(2000) *Bioinformatics* Oxford University Press
15. Persuki,Jr and Persuki (1997*) The internet and new biology :tools for genomics and molecular research* ASM Press

MB104 - LAB – 1: Microbial Biochemistry and Bioinformatics

PART I – MICROBIAL BIOCHEMISTRY

1. Separation of serum proteins by electrophoresis.
2. Separation and identification of amino acids by paper chromatography and Thin Layer Chromatography.
3. Separations of proteins by SDS - PAGE.
4. Measurement of cellulase by reducing sugar assay test.
5. Estimation of glycogen in a bacterial cell.
6. Estimation of glucose in a bacterial cell.
7. Estimation of protein in a bacterial cell by Lowry' method.
8. Estimation of amino acid content in a bacterial cell using colorimetric method.
9. Measurement of alkaline phosphatase activity.
10. Nitrate reductase assay in vivo.
11. Measurement of enzyme activity of alpha amylase.
12. Effect of temperature on enzyme activity.

PART II - BIOINFORMATICS

1. Analysis of Nucleic Acid Sequences
2. Sequence Similarity Searching
3. ORF Prediction
4. Multiple sequence Alignment
5. Molecular Phylogeny
6. Gene Structure and Function prediction
7. Protein structure analysis

REFERENCES: -

1. Beedu Sasidhar Rao and Vijay Deshpande (2006) *Experimental Biochemistry: A student companion* IK International Pvt.Ltd

2. Sawhney, S.K and Randhir Singh (2001) *Introductory Practical Biochemistry* Narosa Pub House

3. Dubey, R.C and Maheswari, D.K (2010) *Practical Microbiology* Chand &Company

4. Cappucino, J.G & Sherman, S (2010*) Microbiology. A Laboratory Manual* 9 th edition Benjamin-Cummings Publishing Company

5. Aneja, K. R (2009*) Experiments in Microbiology, Plant Pathology and Biotechnology* New Age International

6. Varley, H (1988) *Practical Biochemistry* CRC Press

MB105 - Industrial Visit

SECOND SEMESTER

MB201- GENERAL MICROBIOLOGY

UNIT I

Early earth – origin and diversification of life, Evolutionary tree of life, Microbial Phylogeny, Microbial evolution, Prokaryotic and eukaryotic cell, Historical roots of microbiology. An overview of microbial world. Bacteria and archaea. Principles of bacterial taxonomy, Molecular taxonomy, Species concept in Microbiology, Intraspecies classification of bacteria, Bergey's manual of systematic bacteriology

UNIT II

Bacteria - General characteristics, Morphology, Structure and Classification. Structure and biosynthesis of peptidoglycan. Bacterial identification methods. Ribotyping, Ribosomal Database Project, Archaea - General characteristics and Adaptations, Viruses – morphology, structure, unique properties and classification. Virion, Viroids and Prions. Viral replication. Viral diversity–bacterial, plant and animal viruses. General Characteristics and classification of fungi (Ainsworth) and algae.

UNIT III

Cultivation of bacteria- culture media and methods. Factors influencing microbial growth. Environmental and nutritional factors. Nutritional types of bacteria. Autotrophs and Chemolithotrophs, Bacterial growth curve. Binary fission, Microbial growth at different temperature, pH and oxygen level. Continuous cultures. Maintenance and transport of cultures. Culture Collection Centres, Metagenomics, Microbial locomotion – flagellar motility, gliding motility and amoeboid motion. Chemotaxis and Phototaxis. Measurement of bacterial growth.

UNIT IV

Sterilization and Disinfection – principles, methods and mechanism of action, Physical agents, Radiation and Chemical agents, Testing of disinfectants, Thermal death time, Plasma sterilization, Antibiotics – mechanism of action. Antibiotic sensitivity tests, Principles, functioning and types of Biosafety cabinets

UNIT V

Genetic materials in bacteria. Bacterial chromosome. Extrachromosomal genetic elements. Plasmid, Replication of plasmid. Transposable elements, Integrons and Antibiotic resistance cassettes, Drug resistance in bacteria and the mechanisms involved, Mutation-causes and types, DNA repair mechanisms. Mechanisms of gene transfer – transformation, transduction and conjugation. Recombination- types, mechanism and enzyme involved.

REFERENCES

1. Talaro, K.P. and Talaro, A.(1999) *Foundations of Microbiology* 4th edition. McGraw-Hill Publication

2. Pelczar,M.J., Chan,E.C.S. and Kreig,N.R.(1986) *Microbiology* 5th edition. McGraw-Hill NY Publication

3. Willet,J., Sherwood,L. and Woolverton,C.(2007) *Prescott, Harley and Klein's Microbiology* 7th edition. McGraw-Hill Higher education

4. Salle,A.J.(2007) *Fundamental Principles of Bacteriology*. Envins Press

5. Madigan,M.,Martinko,J.,Stahl,D. and Clark,D.(2011) *Brock Biology of Microorganisms* 13th edition. Pearson Publication

6. Ketchum,Paul A. (1988) *Microbiology:Concepts and Application*. John Wiley &Sons Publication

7. Davis,B.D., Dulbecco,R., Eisen,H.N.and Ginsberg,H.S.(1990) *Microbiology* 4th edition. Lippincott Williams &Wilkins Publication

8. Black,J.G.(2012) *Microbiology: Principles and Explorations* 8th edition.Wiley Publishers

MB202 - Immunology and Immunotechinques

UNIT I

Infection- methods of transmission. Immunity - Types of immunity. Innate Immunity and Adaptive Immunity, Mechanisms of innate immunity, Inflammation, phagocytosis-mechanisms, Opsonisation, Receptors of Innate Immune system, Pattern recognition receptors and PAMP, Scavenger receptors and the Toll-like receptors. Organs and cells with immune functions. Lymphocytes and lymphocyte maturation.

UNIT II

Antigens, Antigenicity and Immunogenicity, Adjuvants, Epitopes, Hapten, Super antigens, Immunoglobulin – structure, classes and functions, Isotype, Allotype, Idiotype. Fc receptors. Monoclonal antibodies – production and applications, Antibody engineering. Genetic basis of antibody diversity, Organization and Expression of Immunoglobulin Genes, Mechanism of variable gene rearrangement, Recombination Signal Sequences, V(D)J rearrangements, P-addition, N-addition, somatic hypermutation and affinity maturation, Class-switching, Synthesis of immunoglobulins, Antigen-antibody reactions, General features, Affinity, Avidity and Cross reactivity, Agglutination and Precipitation Reactions, Passive agglutination, Agglutination Inhibition reaction, Complement fixation, Radioimmuno assay, Immunoflourescence, ELISA- various types, Western blotting, Flow cytometry.

UNIT III

Receptors on T and B cells for antigens, Organization and Rearrangement of TCR genes, T-cell accessory membrane molecules, Co-stimulatory signal, Clonal anergy, Signaling pathways by activation of TCR, ITAM, T-cell maturation, activation and differentiation, Cell mediated Immune response, B cell- generation, activation, differentiation, B-cell coreceptor complex, Humoral Immune response, Primary and secondary immune response, Clonal selection theory. Cytokines, MHC, HLA typing, MHC-restriction, Antigen processing and presentation, Complement system, Complement activation, Classical, Alternative and Lectin complement pathway, regulation of complement activation, Biological effects of complements

UNIT IV

Immunology of organ and tissue transplantation, types of grafts, Allograft reaction and GVH reaction, Histocompatability testing, Immunosuppression, Factors influencing allograft survival, Immunology of malignancy- Tumor antigens, TATA, TSTA, Immune response in malignancy, Mechanisms of immune evasion by tumors, Immunotherapy of cancer, LAK cells, TILs, Immunohematology- ABO and Rh blood group system, Immunology of blood transfusion, Hemolytic disease of new born.

UNIT V

Immunological Tolerance, Autoimmunity- Mechanisms of autoimmunity, Classification of Autoimmune diseases. Hypersensitivity– immediate and delayed reactions, Types of hypersensitivity reactions and their features, Immunodeficiency diseases- primary immunodeficiency and secondary immunodeficiency disease, Immunoprophylaxis, Vaccines –types of vaccines, DNA vaccine and recent trends in vaccine development, Routine immunization schedules

REFERENCES

1. Tizard, I. (1994) Immunology : An Introduction 4th edition. Cengage Learning Publishers
2. Delves,P.J.,Martin,S.J.,Burton,D.R., Roitt,I.M. (2011) *Roitt's Essential Immunology* 12th edition. Wiley-Blackwell Publishers
3. Chakravarthy,A.K.(2006) *Immunology and Immunotechnology.* Oxford University Press
4. Lombard, M.F.,Coleman,R.M.,Sicard,R.E.(1999) *Fundamental Immunology* 2nd edition. McGraw-Hill Higher Education
5. Kuby Immunology, Sixth Edition
6. Khan,F.H. (2009) *The Elements of Immunology* 1st edition.Pearson Publishers
7. Klaus D.E.(1996) *Immunology:Understanding the Immune system*.Wiley-Liss Publishers
8. Joshi,K.R. and Osama,N.O.(2004) *Immunology and Serology.* Student edition Jodhpur Publishers
9. Abbas,A.K.,Lichtman,A.H.H., Shiv Pillai (2011) *Cellular and Molecular Immunology* 7th edition. Elseiver Saunders Publishers
10. Yadav,P.R.(2010) *Immunology*. Discovery Publishing Pvt Ltd

MB203 - Recombinant DNA Technology

UNIT I

History of recombinant DNA technology, Purification of DNA from living cells, Enzymes used for in vitro DNA manipulation and their mechanism of action. DNA polymerases, Restriction Endonucleases, Kinases, Phosphatases, Ligases, Terminal Transferases, Functions and applications of Adapters and Linkers and Homopolymer Tailing. Reverse transcription and cDNA synthesis.

UNIT II

Plasmids - desirable properties of plasmid cloning vectors, Construction of prototype vector pBR322, Vectors derived from pBR322, Bacteriophages λ- Replication of phage λ DNA in lytic and lysogenic cycles, structure of bacteriophage λ cloning vectors EMBL3 and EMBL4, Packaging phage λ DNA *in vitro,* M13vectors, Cosmid vector - scheme for cloning in a cosmid vector, Phagemids, BAC, PAC, Shuttle Vectors, Ti plasmid and Binary vector system, Expression vectors, Promoters, and reporter systems, Prokayotic expression system, Fusion tagged expression system, Purification of recombinant proteins. Strategy for regulating the expression of genes cloned into a pET vector, Vectors for Yeast expression, Yeast two hybrid system, Mammalian Expression vectors.

UNIT III

Techniques used in recombinant DNA research, Blotting techniques -southern, northern and western, chromosome walking, chromosome jumping. PCR - principle and types, Chemical synthesis of DNA, DNA sequencing methods, Sangers dideoxy sequencing. Next Generation and Advanced sequencing technologies, pyrosequencing. Changing genes - site-directed Mutagenesis, SDM- methods, Overview of various steps involved in cloning, Construction, Screening and applications of genomic DNA and cDNA library. Cloning of full length cDNA, RACE, Subtraction cloning, differential mRNA display technique

UNIT IV

Bacterial transformation, Selection of recombinants, Blue white screening, Antibiotic resistance selection, Introduction to animal cell culture, Gene transfer to animal cells, Genetic manipulation of mammals, Introduction to plant tissue culture, Gene transfer to plant cells – Electroporation and Biolistics, Agrobacterium mediated transformation, Advances in transgenic technology, Inducible expression system, Recombinant inducible systems.

UNIT V

Applications of recombinant DNA technology, Nucleic acid sequences as diagnostic tools, New drugs and new therapies for genetic diseases, Gene therapy, Recombinant vaccines and hormones, Imparting new agronomic traits to plants – resistance to abiotic and biotic stress, improving quality and quantity. Golden rice, edible vaccine, Improving therapeutic proteins

with single amino acid changes, Protein engineering, Metabolic engineering, biosynthesis of indigo in *E. coli* , Combinatorial biosynthesis, Gene Silencing, RNA interference, antisense therapy, Gene Knockout.

REFERENCE: -

1. Nicholl D.S.T(2002) *An introduction to Genetic Engineering* 2nd edition. Cambridge University Press
2. Glick,B.R., Pasternak, J.J.(2003) *Molecular biotechnology* 3rd edition.ASM Press
3. Primrose,S.B., Twyman,R., Old,R.W.(2002) *Principles of Gene Manipulation* 6th edition. Wiley-Blackwell Publishers
4. Brown T.A.(2010) *Gene Cloning & DNA Analysis* 6th edition. Wiley-Blackwell Publishers
5. Sambrook, J and Russell,D.W.(2001) *Molecular Cloning : a laboratory manual* 3rd edition. Cold Spring Harbor laboratory Press
6. Nair,A.J (2008) *Introduction to Genetic Engineering and Biotechnology* . Infinity Science Press
7. Singh, B.D.(2010) *Biotechnology* 4th edition. Kalyani Publications
8. Rigby P.W.J.(1982) *Genetic Engineering*. Academic Press NY
9. Russel G.E.(1992) *Biotechnology and Genetic Engineering Reviews*. Intercept Ltd
10. Marcus,D.A., Goldsby,R.A. and Osborne, B.A. (2002) *Immunology*.W.H.Freeman & Co

MB204 - LAB 2: General Microbiology, Immunology and Recombinant DNA Technology

PART I - GENERAL MICROBIOLOGY

1. Cleaning and sterilization of glass wares.
2. Preparation of solid and liquid media and their sterilization.
3. Uses and study of microscopes.
4. Measurement of micro organisms – micrometry.
5. Bacterial cell counting by haemocytometer.
6. Staining of bacteria
    - i) Simple staining.
    - ii) Gram staining.
    - iii) Negative staining.
    - iv) Capsule staining
    - v) Endospore staining.
    - vi) Acid – fast staining.
7. Microscopic test for bacterial motility by hanging drop method.
8. Evaluation of potency of disinfectant by phenol coefficient method.
9. Cultivation of bacteria
    - i) Pour plate method.
    - ii) Spread plate method.
    - iii) Streak plate method.
    - iv) Anaerobic culture method
10. Study of cultural characteristics of bacteria and biochemical reaction of bacteria
11. Antibiotic sensitivity tests- disc diffusion, MIC
12. Bacterial growth curve
13. Measurement of bacterial growth by turbidity method.
14. Effect of pH, osmotic pressure, incubation temperature, dyes, chemicals on bacterial growth.
15. Isolation of fungi using suitable media.
16. Identification of fungi by lactophenol cotton blue mounting and study of the cultural characteristics of various fungi.

PART II - IMMUNOLOGY

1. Diagnosis for in vitro detection of CRP qualitative latex slide test.
2. RPR card test for syphilis.
3. WIDAL test.
4. ASO Latex agglutination test.
5. RA Latex agglutination test.
6. ELISA test
7. Determination of blood group and Rh factor.
8. Pregnancy testing using the immunological methods.

PART III - RECOMBINANT DNA TECHNOLOGY

1. PAGE- Protein separation
2. DNA and RNA isolation from different sources
3. Estimation of DNA and RNA
4. Agarose gel electrophoresis of nucleic acids
5. Bacterial transformation and blue white screening
6. Plasmid isolation
7. Restriction enzyme digestion
8. Polymerase Chain Reaction

References

1. Cheesbrough M (2006) *District Laboratory Practice in Tropical Countries. Vol.2*

2. Cambridge University Press. 2nd ed.

3. Collee JG & Mackie TJ (1996) *Mackie and McCartney Practical Medical Microbiology*

4. Churchill Livingstone, Edinburgh. 14th ed

5. Gradwohl RBH, Sonnenwirth AC, & Jarett L (1980) *Gradwohl's Clinical Laboratory*

6. *Methods and Diagnosis* .Mosby, St Louis, Mo. ; London. 8th ed

7. Dubey RC & Maheshwari DK (2002) *Practical Microbiology* (S. Chand & Company Limited

8. Aneja KR (2003) *Experiments In Microbiology, Plant Pathology And Biotechnology*. New Age International.

9. Sambrook J. and Russell D. 2001. *Molecular Cloning: A Laboratory Manual*, 3rd edition.

10. Cold Spring Harbor Laboratory Press, Cold Spring Harbor, New York.

11. Sambrook J., Fritsch E.F., and Maniatis T. 1989. *Molecular Cloning: A Laboratory Manual*, 2nd edition. Cold Spring Harbor Laboratory Press, Cold Spring Harbor, New York.

THIRD SEMESTER

MB301 - Environmental and Agricultural Microbiology

UNIT I

Aerobiology, Microbial contamination of air, Sources of contamination, Microbial indicators of air pollution. Enumeration of bacteria in air, Air sampling devices. Air sanitation. Effect of Air Pollution on plants and humans.

UNIT II

Aquatic microbiology: Microbiology of water , Water pollution and water borne pathogens, Bacteriological examination of water, Indicator organisms. Purification and disinfection of water Microbiology of sewage, Waste water treatment, BOD, COD. Role of microbes in marine fouling

UNIT III

Microbial flora of soil and factors affecting them, Key processes and role of microorganisms in Nitrogen, Carbon, Phosphorus, Sulphur and Iron cycles.

UNIT IV

Microbial interaction – Plant-microbe, microbe-microbe interactions. Endophytes, PGPR-mechanisms of plant growth promotion by PGPR, Plant Microbiome, Mycorrhiza, Biological Nitrogen fixers-Symbiotic and free living nitrogen fixers- physiology and genetics of nitrogen fixers, Phosphate solubilizers, Phytopahtogens – Bacterial , fungal, Viral diseases. (Wilt, Blight, Canker, Mosaic, Rhizome rot of ginger etc.) – Control measures. Biofertilizers, Microbial control of pests and diseases. Bt-toxin- mode of action and applications, Integrated pest management. GM crops and its importance

UNIT V

Recycling of liquid and soild wastes – Composting – Biogas – Biodegradation. Bioremediation, Bioleaching, Xenobiotic degradation. Microbial corrosion- Biofilms degradation of petroleum products. Microbes in mineral leaching and metal concentration, Microbial enhanced oil recovery

References:

1. Mitchell R (1974) *Introduction to environmental microbiology* (Prentice-Hall, Englewood Cliffs, N.J.,)

2. Atlas RM & Bartha R (1998) *Microbial ecology : fundamentals and applications* (Benjamin/Cummings, Menlo Park, Calif. ; Harlow) 4th ed.

3. Campbell RE (1983) *Microbial ecology* (Blackwell Scientific Publications, Oxford ; Boston) 2nd ed

4. Rheinheimer G (1991) *Aquatic microbiology* (John Wiley and Sons) 4th ed. Dart RK (1980) *Microbiological aspects of pollution control* (Elsevier Scientific, Amsterdam) 2nd ed.

5. Alexander M (1977) *Introduction to soil microbiology* (Wiley, New York ; London) 2nd ed.

6. Rao NSS (1995) *Soil microorganisms and plant growth* (Science Publishers, Inc.; New Hampshire, U.S.A) 3rd ed.

7. Pandey,B.P. (2001) *Plant Pathology : Pathogen and Plant Disease*. S.Chand & Co

8. Sharma, P.D. (2012) *Plant Pathology*. Rastogi publication

9. Rangaswami, G., Bagyaraj, D.J. (2007) *Agricultural Microbiology* 2nd edition .Prentice Hall publishers

MB302 - Food and Dairy Microbiology

UNIT I :

Microorganisms associated with food, Factors affecting the microbial growth in food – intrinsic, extrinsic, implicit and processing factors. Hurdle effect, Food contamination and spoilage. Microbial spoilage of cereals, poultry, fish, meat, egg, stored grains fruits and vegetables. Spoilage of canned foods. Microbiological examination of food.

UNIT II

Food preservation, physical and chemical methods. Natural food preservatives, Developments in the history of fermented foods, Nutritional value of fermented foods. Lactic acid bacteria, Genera of lactic acid bacteria and their properties, Homofermentative and Heterofermentative LAB, Heterolactic end products from pyruvate metabolism. Sugar Transport by Lactic Acid Bacteria, Proteolytic system in lactococci, Yeasts and mold used in manufacture of fermented food, Starter cultures used for fermented food and their properties. Fermented food products- making of pickles, fermented vegetables, Changes in microbial population during vegetable fermentation, Fermentation succession during sauerkraut fermentation, Traditional fermented foods.

UNIT III

Composition of milk, Pasteurization, Preservation of milk. Microbial examination of milk, Role of microbes and microbial enzymes in the manufacture of dairy products, Organisms used as starter culture in the manufacture of fermented dairy products, Yogurt Manufacture, Nutritional Benefits of Yogurt, sour cream, kefir, traditional and modern manufacturing of kefir, manufacture of cultured buttermilk, Cheese, General steps in cheese making, Cheese-types, Microbial contamination of milk

UNIT IV

Food borne infections and intoxications, bacterial and non-bacterial, pathogenesis, clinical features, isolation, identification and association with food, Mycotoxins and mycotic poisoning, Prevention measures, Food control agencies and their regulations. Laboratory testing of foodborne outbreaks, Indicator organisms.

UNIT V

Production of edible mushrooms, Importance of Bifidobacterium. Nisin and its applications, SCP, Probiotics- health benefit and mechanism of action, prebiotics, and synbiotics. Hazard analysis and clinical control point system.

REFERENCES

1. Adams,M.R. and Moss, M.O.(2008) *Food Microbiology* .New Age International Publishers

2. Frazier, W.C. and Westhof, D.C.(1978)*Food Microbiology* . Tata McGraw-Hill Co.Inc.

3. Banwart, G.J.(1989) *Basic Food Microbiology* 2nd edition. Van Nostrand Reinhold Publishers NY

4. Jay, J.M.,Loessner,M.J.,Golden,D.A.(2005) *Modern Food Microbiology* 7th edition. Springer Publishers

5. Hobbs, B.C. and Roberts, D.(1991) *Food poisoning and food hygiene* 6th edition.Sevenoaks:Edward Arnold Publishers

6. Stanbury, P.F, Whitakar, A. and Hall, S.J.(1995) *Principles of Fermentation Technology* 2nd edition. Pergamon Press Oxford

7. Robinson, R.K.(2002) *Dairy Microbiology Handbook:The Microbiology of Milk and Milk Products* 3rd edition. Wiley-Interscience Publishers

MB303 - Industrial Microbiology

UNIT I

Historical account of microbes in industrial microbiology, Sources and characters of industrially potent microbes. Isolation, purification and preservation of industrially useful microbes, Screening methods and methods for strain improvement.

UNIT II

Microbial growth kinetics, Batch, continuous and fedbatch culture, Monod's model and deviations from Monod's model. Batch culture - specific growth rate, substrate saturation constant, yield coefficient, substrate affinity. Continuous culture- Dilution rate and Washing out. Applications and examples of fedbatch and continuous system, comparison between various cultivation systems

UNIT III

Industrial fermentations. Types of fermentations. Components of fermentation process, Media for industrial fermentation, sterilization, inoculum preparation, raw materials used in industrial fermentation media, antifoam agents, Solid substrate fermentation (SSF) - Principles and application, Submerged Fermentation. Aerobic and anaerobic fermentation, Problems in fermentation process and handling.

UNIT IV

Fermentor – parts, design, construction and types, Pneumatically driven, hydrolytically driven, mechanically driven, CSTR, Airlift, Packed Bed, Fluidized Bed, cyclone, cylindro conical fermentors, Monitoring and control of fermentors, Control of physical and chemical conditions, online and off line instrumentation, pH, temperature, DO probes. Methods used for down-stream processing and product recovery- filtration, centrifugation, celldisruption, extraction, dialysis, Purification, Drying, Packing and labeling. Good Manufacturing Practices, Fermentation economics.

UNIT V

Microbiology and production of ethanol and alcoholic beverages, Beer manufacturing and production of distilled beverages. Microbial polyesters, biosurfactants, and recombinant products. Microbial process for the production of antibiotics (penicillin and streptomycin), vitamins (Vit. C, Vit. B12), organic acids (citric acid, lactic acid) amino acids, alkaloids, nucleotides and microbial transformation of steroids, Baker's yeast production, Bread manufacturing. Production of microbial enzymes - amylases and proteases and their applications. Immobilization of microbial cells and enzymes – methods and applications.

REFERENCES

1. Aneja K.R., Jain, P and Aneja. (2008) *A text Book of Basic and Applied Microbiology* New Age International

2. Stanbury, P.F., Whitekar A and Hall. (2000) *Principles of Fermentationtechnology* Butterworth-Heinemann

3. Rehm ,H.J., Reed,,G.(1989) *Biotechnology* Wiley-Blackwell

4. Reed, G (2004).*Prescott& Dunn'sIndustrial Microbiology* CBS Publishers

5. L.E.Cassida(1991) *Industrial Microbiology* Wiley Eastern

6. Patel,A.H(2000) *Industrial Microbiology* MacMillan

7. Bhosh,T.K., Fiechter,A and Blakebrough,N. *Advances in Biochemical Engineering* Springer

MB304 - LAB - 3 Environmental, Agriculture, Food, Dairy and Industrial Microbiology

PART I - Environmental Microbiology

1. Isolation of micro organisms from different sources – air and water.
2. Analysis of water
3. sample for total bacterial population by SPC.
4. Analysis of water samples – Biological parameters.
    - i) Determination of dissolved oxygen.
    - ii) Determination of BOD.
    - iii) Determination of COD.
    - iv) Bacteriological examination of water by - SPC, Presumptive, Confirmed and Complete test etc. (potability of water sample).
    - i) Tests for coliforms by membrane filter technique.
    - ii) IMViC tests for the identification of coliforms.

PART II - Agriculture Microbiology

1. Isolation of microorganisms from soil (bacteria and fungi).
2. Isolation of microbes from crops infected with bacterial diseases and fungal diseases.
3. Isolation and identification of *Rhizobium* from root nodules.
4. Isolation of *Azotobacter* from rhizosphere soil.
5. Isolation of *Azospirrilum* from soil.
6. Isolation of Phosphobacteria from soil.
7. Isolation of blue green algae and their microscopic observation.
8. Microscopic examination of VAM infection.

PART III - Food and Dairy Microbiology

1. Microbiological examination of foods.
    - i) Isolation and enumeration of bacteria and fungi from fresh and spoiled fruits.
    - ii) Isolation and enumeration of bacteria and fungi from fresh and spoiled vegetables.
    - iii) Isolation and enumeration of bacteria from fruit juices.
2. Detection of bacteria in spoiled tinned food.
3. Food preservation.
    - i) Pickle preparation.
    - ii) Squash preparation.
    - iii) Jam preparation.
4. Effect of food preservatives on the growth of microbes.
5. Isolation of *Aspergillus flavus* from spoiled food.
6. Analysis of mycotoxin (aflatoxin) in fungus contaminated food materials.

PART IV Industrial Microbiology

1. Quantitative analysis of milk by standard plate count method.
2. Determination of quality of milk sample.
    i) Methylene Blue Reduction Test.
    ii) Resazurin Test.
3. Alkaline phosphatase testing of raw and pasteurized milk
4. Microbial production of curd.
5. Solid state and submerged fermentation
6. Production of wine from grapes.
7. Fermentation of yeast and quantitative estimation of ethanol produced during yeast fermentation.
8. Amylase production by bacteria and fungus.
9. Citric acid production.
10. Cultivation of edible mushroom.

REFERENCE: -

1. Dubey,R.C and Maheswari,D.K (2002)*Practical Microbiology S*.Chand Ltd

2. Cappuccino,J.G.,Sherman,S(2002) *Microbiology. A Laboratory Manual* Benjamin-Cummings Publishing Company

3. Aneja KR (2003) *Experiments In Microbiology, Plant Pathology And Biotechnology*. New Age International.

MB305 - Electives

EXTREMOPHILES

UNIT I

Microbial Diversity in extreme environment. Peculiar features of Archaea compared to bacteria. Identification of microbes in extreme environment.

UNIT II

Thermophiles-classes, extremely thermophilic archaebacteria, thermozymes, psychrophiles-psychrophilic archael extremozymes, Molecular adaptation of extremophiles. Protein stability in extremophilic microbes.

UNIT III

Halophiles-osmoregulation, cellular adaptation, structural adaptation, molecular adaptation.Xerophiles. Radiation resistant bacteria-*Deinococcus radiodurans*

UNIT IV

Biotechnological applications of archaea. Bioelectronics from lipids of archaea. Space microbiology-introduction. Panspermia-definition,mechanisms proposed. Microbiological research in space environment.

References :

1. Johri, B.N(2000)*Extremophiles* .Springer V erlag. , New York

2. Colwd , D.(1999) *Microbial Diversity*. Academic Press.

3. Kushner,D.J(2007)*MIcrobial Life in Extreme Environments*,.Academic Press.

4. Edward,C(1990) *Microbiology of Extreme Environments*. Open University Press.

5.Da Costa,M.S., Duarte,J.C & Williams,R.A.D(1989) *Microbiology of Extreme Environments and its potential for Biotechnology*. Elsiever Applied Science, London.

6.Heinrich,M.R (1976)*Extreme Environment: Mechanism of Microbial Adaptation*. Academic Press.

7. Thomas, D(1988) *Thermophiles: General, Molecular and Applied Microbiology.*Wiley-Interscience Publication.

8. Perry,J.J.,Staley,J(1997*)Microbiology: Dynamics and Diversity* .Saunders College Publishing

9.. Atlas,R.M.,and Bartha,R (1998) *Microbial Ecology. Fundamentals and Applications* . The Benjamin Cummins Publication Co. Inc.

10.Campbell,R.E(1984). *Microbial Ecology*.Blackwell Scientifc Publication.

11. Madigan,M.T.,Martinko,J.M.,Parker,J John(1997) *Brocks Biology of Microorganisms*. Prentice-Hall

12.. Oganseitan,O (2005) *Microbial diversity-form&function in prokaryotes* .Blackwell publishing

MARINE MICROBIOLOGY

UNIT I

Marine environment – sea-benthic and littoral zone, salt pan, mangroves and estuarine microbes, microbial loop – marine microbial community – planktons, bacteria, fungi, protozoa. Methods of collection and estimation of marine microbes. Influence of physical, chemical and biological factors on marine microbes.

UNIT II

Pathogenic marine bacteria ,pathogenic human viruses in coastal waters. Public health risk.

UNIT III

Microorganisms responsible for bioluminescence in marine environment. Uses of bioluminescence. Mechanism of quorum sensing in *Vibrio fischeri.* Microbial indicators of marine pollution and control, biofouling, biocorrosion, biofilms, biodegradation and bioremediation of marine pollutants.Use of genetically engineered microorganisms in biodegradation.

UNIT IV

Marine natural products, bioactive compounds from marine microorganisms, marine bio-sensor. Biosurfactants, biopolymers and novel enzymes from marine organisms.

References

1. Karl,D & Buckley,M (2005) *Marine Microbial Diversity*

2. Mitchell,R(2008) *Microbial Ecology of the Oceans* Wiley

3. Colwell,R & Belkin,(2010) *Ocean & health: Pathogens of the Marine Environment* Springer

4. Miller,C.,Wheeler,P.A (2012) *Biological Oceanography* Wiley-Blackwell

PHARMACEUTICAL MICROBIOLOGY

UNIT I

History; contributions of Paul Ehrlich, Edward Jenner, Alexander Fleming. Bioactive molecules – extraction, purification and characterization; safety profile, toxicological evaluation of drugs, mutagenicity, carcinogenicity and teratogenicity. Drug interactions and drug metabolism.

UNIT II

Introduction of medicines in market- role of FDA clinical trials- objectives, conduct and outcome; drug delivery systems

UNIT III

Different types of antibiotics; mechanism of action of antibiotics; assay of antibiotics-penicillin; vaccines – active and passive immunization; conventional bacterial and viral vaccines

UNIT IV

Pharmacognosy – brief introduction. Significance in Indian systems of medicine-Siddha,ayurveda and unani. Active principles and medicinal uses of the following-*Adathoda vasica, Rauolfia serpentina, Curcuma longa, Ocimum sanctum, Coleus aromaticus* and *Phyllanthus niruri*. Antimicrobial activity testing of herbal extracts.

References

1. Agarwal S. S. and Paridhavi M., (2007), *Herbal Drug Technology*, Universities Press (India) Pvt. Ltd

2. Bentley's Textbook of Pharmaceutics, Editior E. A. Rawlins, 8th Ed. (2002), BAilliere Tindall, London

3. Chatwal G. P. (2003) *Biopharmasceutics and Pharmacokinetics*, Himalaya Publishing House, Mumbai.

4. Chorghade Mukund S., (2006), *Drug discovery and development Volume I: Drug discovery*, Wiley-Interscience, John Wiley and Sons Inc. USA.

5. Dewick Paul M., (2002), *Medicinal natural products: A biosynthetic approach*, 2nd Ed., John Wiley and Sons

6. Gale E. F., Cundliffe E., Reynolds P. E., Richmond M. H. and Waring M. J., (1972), *The molecular basis of antibiotic action*, John Wiley and Sons, London

7. Iyengar M. A. (1974) *Pharmacology of Powdered Crude Drugs*, Manipal

8. Kokate C. K., Purohit A. P., Gokhale A. B. (2000) *Pharmacology*, 4th Ed., Nirali

Prakashan.

9. Lorian.V., (1986), *Antibiotics in laboratory medicine*, 2nd Ed, Williams & Wilkins Publication
17. Mannfred A. Holliger, (2008), *Introduction to pharmacology*, 3rd Ed., CRC Press

10. Micheles P. S., Y. L. Khmelnitsley, J. S. Dordick and D. S. Clark, (1998), *Combinatorial Biocatalysis, A Natural Approach to Drug Discovery*, Trends in Biotechnol. **16,** 197.

11. National Committee for Clinical Laboratory Standards (now Clinical and Laboratory Standards Institute, CLSI). *Methods for dilution antimicrobial susceptibility testing for bacteria that grows aerobically. Approved Standards M7-A4*. Villanova, PA: NCCLS, 1997.

12. National Committee for Clinical Laboratory Standards (now Clinical and Laboratory Standards Institute, CLSI). *Performance standards for antimicrobial susceptibility testing; 12th information supplement (M100-S1)*. Villanova, PA; NCCLS: 2002

13. Satoskar R. S. & S. D. Bhandarkar (1991) *Pharmacology and Pharmacotherapeutics*, 12th Ed., Vol. 1 & 2, Popular Prakashan, Mumbai.

14. Sylvie E. Blondelle, Enrique Pe´Rez-Paya, And Richard A. Houghten, (1996), *Synthetic Combinatorial Libraries: Novel Discovery Strategy forIdentification of Antimicrobial Agents,* Antimicrobial Agents and Chemotherapy, 1067–1071

15. Walsh Gary, (2003), *Biopharmaceuticals Biochemistry And Biotechnology,* 2nd Ed., John Wiley & Sons Ltd, England

16. Vyas S. P and Dixit V. R. (2002), *Pharmaceutical Biotechnology*, CBS Publishers and Distributors, New Delhi

BIOINFORMATICS

UNIT I

General introduction (characteristics, capabilities and generations of computers). Software and hardware, Basic Structure of a computer (memory unit, control unit, arithmetic and logic unit), input devices, output devices, Types of software (system software, application software), languages - (low level, intermediate level and high level).Number systems, Truth Table (basic operations like AND, OR, NOT), Binary addition, subtraction, flow chart. Basics of MS Word, MS Excel and MS Power point. Basics of operating systems, Necessity of Operating System, Functions of an operating system, Types of operating systems - Batch Systems, Time Sharing Systems, Real Time Systems, Basic Structure of an Operating System, User Interface, Types of User Interface (CUI, GUI). Introduction to networking (LAN, WAN, MAN), Network Topology, Internet, web servers, application of networking, WiFi, Bluetooth, WLAN, down loading files with anonymous FTP, Gopher and Mosaic.

UNIT – II

Bioinformatics- definition. History and evolution of bioinformatics, impact of bioinformatics in modern biology. - Genomics, proteomics. Biological databases – NCBI, DDBJ, EBI, PROSITE, PDB, EMBL, Gene bank, Pub med, structural data bases, derived and specialized data bases , Sequence analysis softwares

UNIT – III

Tools (software) in bioinformatics. Tools of sequence alignments – BLAST (nucleotide, protein) FASTA, Clustal X and RASMOL. Phylogenetic analysis, construction of phylogenetic tree, prediction of evolutionary changes in nucleotide and protein sequences, structure prediction, structural alignment tools, homology modeling, drug design. A short introduction to genome analysis, genome sequencing projects, genome similarity.

UNIT – IV

Applications of bioinformatics- pharmaceutical industry, immunology, agriculture, forestry, basic research, chemiinformatics in biology, geoinformatics, legal ethical and commercial considerations. Internet resources for bioinformatics – websites (NCBI, EBI, DDBJ).

Reference

1. Kothekar,V(2004)*Introduction to Bioinformatics* 1st edition Dhruv publication

2. Baxevaris,A.D. *Bioinformatics* B.F Publication

3. Higgins ,D.,Taylor,W(2000) *Bioinformatics* Oxford University Press

4.Persuki,Jr and Persuki (1997*) The internet and new biology :tools for genomics and molecular research* ASM Press

5.Heath,L.S.,Ramakrishnan,N(2011)*Problem solving hand book in computational biology and bioinformatics* Springer

FOURTH SEMESTER

MB401- Medical Bacteriology

UNIT I

History of Medical Microbiology, Infections - Sources and classification, Mode of transmission of infections, Types of infectious diseases, Factors predisposing to microbial pathogenicity. Normal microflora of human body, Human Microbiome, Human Microbiome Project.

UNIT II

General characters, pathogenicity, epidemiology and laboratory identification of *Staphylococci, Streptococci* and *Neisseriae*, *Corynebacterium, Bacillus*, and *Clostridia*

UNIT III

General properties, morphological and cultural characters, pathogenicity, epidemiology and laboratory identification of *E.coli, Proteus, Klebsiella, Shigella, Salmonella, Pseudomonas, Haemophilus, Pasteurella, Yersinia, Francisella, Bordetella, Brucella* and *Vibrio*.

UNIT IV

Identifying characters, morphological and cultural features, pathogenicity, epidemiology and laboratory identification of Spirochetes, Mycoplasma, Rickettsiae, Chlamydiae, *M.tuberculosis, M.leprae*, and Non tuberculous mycobacteria.

UNIT V

Study of important properties and clinical importance of Actinomycetes- *Nocardia, Actinomyces*, General characters and clinical importance of *Listeria, Campylobacter, Helicobacter, Legionella, Acinetobacter*

References

1. J.G.Holt, (Ed) *Bergey's Manual of Systematic Bacteriology, Vol.1-4* (1984-1989) Williams and Wilkins, Baltimore.

2. Greenwood, D., Slack, R.C.B., Peutherer, J.F., and Barer, M.R. (2007). *Medical Microbiology : A Guide to Microbial Infections: Pathogenesis, Immunity, Laboratory Diagnosis and Control*. Elsevier Health Sciences UK. 17th ed

3. Topley, W.W.C., Wilson, G.S., Parker, T., and Collier, L.H. (1990). *Topley and Wilson's Principles of Bacteriology, Virology and Immunology* (Edward Arnold)

4. Zinsser, H., and Joklik, W.K. (1992). Zinsser *microbiology* (Lange) 20th ed. 49

5. Ananthanarayan, R., and Paniker, C.K.J. (2006). *Textbook of microbiology*(Orient Blackswan) 7th ed

6. Mackie, T.J., McCartney, J.E., and Collee, J.G. (1989). *Mackie & McCartney practical medical microbiology.* Churchill Livingstone, 13th ed

7. Jawetz, E., Melnick, J.L., and Adelberg, E.A. (1987). *Review of medical microbiology* (Appleton & Lange)

8. Talaro, K.P., Cowan, M.K., and Chess, B. (2009). *Foundations in Microbiology* (McGraw-Hill Higher Education

9. Page, R.D.M., and Holmes, E.C. (1998). *Molecular Evolution: A Phylogenetic Approach* Blackwell Science

10. Primrose, S.B. (1998). *Principles of genome analysis: a guide to mapping and sequencing DNA from different organisms* (Blackwell Science) 2nd ed

11. Adolph, K.W. (1996). *Microbial Genome Methods* CRC Press

12. Dunham, I. (2003*). Genome Mapping And Sequencing* (Horizon Scientific)

13. Brendan Wren (Ed), Nick Dorrell (2002) *Functional Microbial Genomics. Volume 33, Methods in Microbiology*, Academic Press, UK.\

14. Primrose, S.B., and Twyman, R. (2009). *Principles of Genome Analysis and Genomics* (John Wiley & Sons) 3rd ed.

MB402 - Medical Virology, Mycology and Parasitology

UNIT I:

Morphology, structure, classification and nomenclature of viruses. Virus symmetry. Virus cultivation. Bacteriophages. Properties, clinical importance, pathogenesis and laboratory diagnosis of diseases caused by Pox, Herpes, Adeno, Papova, and Parvoviruses.

UNIT II

General properties, clinical importance, pathogenesis and laboratory diagnosis of diseases caused by Picorna, Orthomyxo, Paramyxo, Rhabdo, and Rubella viruses. General characters, clinical importance, pathogenesis and laboratory diagnosis of diseases caused by Arboviruses and Hepatitis viruses, SARS and HIV.

UNIT III

Viral haemorrhagic fevers, Slow virus infections, Prion diseases, Viruses and cancer, Viruses implicated in the cancers of humans, Prophylaxis of viral diseases, antiviral agents. Mechanisms of action Interferons, Emerging viral infections.

UNIT IV

Classification of Mycoses in man, superficial mycoses – surface and cutaneous mycoses, Deep mycoses – subcutaneous and systemic mycoses, pathogenesis, clinical aspects and lab diagnosis of fungal infections. Opportunistic fungal infections.

UNIT V

Life cycle and pathogenesis of important Protozoan diseases- Entamoeabosis, Malaria, Trypanosomiasis and Lieshmaniasis. Clinical importance of *Giardia, Trichomonas, Toxoplasma, Cryptosporidium* and *Pneumocystis*.

References

1. Molyneux, D.H., and Ashford, R.W. (1983). *The biology of Trypanosoma and Leishmania, parasites of man and domestic animals* (New York, International Publications Service)

2. Garraway, M.O., and Evans, R.C. (1991*). Fungal nutrition and physiology* (Malabar, FL, Krieger Pub. Co.).

3. Fields, B.N., Knipe, D.M., and Howley, P.M. (2007). *Fields virology,* 5th edn (Philadelphia, Wolters Kluwer Health/Lippincott Williams & Wilkins) 51

4. Fraenkel-Conrat, H., and Wagner, R.R. (1974). *Comprehensive virology* (New York, Plenum Press).

5. Topley, W.W.C., Wilson, G.S., Parker, T., and Collier, L.H. (1990). *Topley and Wilson's Principles of Bacteriology, Virology and Immunology* (Edward Arnold)

6. Evans and Richardson *Medical Mycology a practical approach* Oxford University Press, Oxford.

7. Emmons, C.W. (1977). *Medical mycology* (Philadelphia, Lea & Febiger) , 3rd ed

8. Rippon, J.W. (1988). *Medical mycology : the pathogenic fungi and the pathogenic actinomycetes* (Saunders ,Philadelphia)

9. Chatterjee, K.D. (2009). *Parasitology* CBS Publishers & Distributors

10. Kucera, L.S., and Myrvik, Q.N. (1985). *Fundamentals of medical virology* Lea & Febiger, Philadelphia

11. Beaver, P.C., Jung, R.C., Cupp, E.W., and Craig, C.F. (1984). *Clinical parasitology* Lea & Febiger, Philadelphia

12. Desselberger, U. (1995). *Medical virology: a practical approach* (IRL Press)

13. Ananthanarayan, R., and Paniker, C.K.J. (2006). *Textbook of microbiology* Orient Blackswan.

MB403 - Clinical and Diagnostic Microbiology

UNIT I

Microbiology Laboratory Safety -General Safety Principles, Handling of Biologic Hazards, Disposal of Infectious waste, Biomedical waste management, infection control practice, emerging and reemerging infections.

UNIT II

Diagnostic cycle, General concept of specimen collection, transport, processing and rejection of clinical specimens. Mailing of biohazardous materials.

UNIT III

Diagnosis of microbial diseases - Clinical, microbiological, immunological and molecular diagnosis of microbial diseases. Modern methods of microbial diagnosis. Automation in Microbiology; Laboratory control of antimicrobial therapy; Immunoprophylaxis

UNIT IV

Normal microbial flora of the human body. Etiological agents and approach to diagnosis of Blood stream infections, Respiratory tract infections, Meningitis, Urinary tract infections, Genital Tract infections, Sexually transmitted diseases, Skin and Soft tissue infections, Nosocomial infections – common types, Sources, reservoir and mode of transmission, and Measures to control

UNIT V

Gastrointestinal Tract infections, Infections of sinuses, eye and ear. bone infections, Pyrexia of unknown origin and Zoonoses. Pyogenic infections. Infections in immunocompromised and immunodeficient patients. Infections in foetus and neonates

References

1. Blair, J.E.e., Lennette, E.H.e., and Truant, J.P.e. (1970). Manual of clinical microbiology.
2. American Society for Microbiology, Bethesda, Md.
3. Gradwohl, R.B.H., Sonnenwirth, A.C., and Jarett, L. (1980). Gradwohl's clinical laboratory methods and diagnosis. Mosby, London.8th ed 53
4. Lennette, E.H., Balows, A., Hausler, W.J., and Shadomy, H.J. (1985). Manual of clinical microbiology. American Society for Microbiology, Washington, D.C. 4th ed.
5. Topley, W.W.C., Wilson, G.S.S., Parker, T., and Collier, L.H. (1990b). Topley and
6. Wilson's principles of bacteriology, virology and immunology. Edward Arnold,8th ed
7. Mukherjee, K.L. (2010) Medical Laboratory Technology .Tata McGraw-Hill Education.2nd ed.

8. Sood, R. 1999. Medical Laboratory Technology - Methods and Interpretations. Jaypee Brothers Medical Publishers (P) Ltd. New Delhi. 5th ed.

9. Cheesbrough, M. (2006). District Laboratory Practice in Tropical Countries. Cambridge University Press.2nd ed.

10. Mackie, T.J., McCartney, J.E., and Collee, J.G. (1989). Mackie & McCartney practical medical microbiology. Churchill Livingstone, 13th ed

11. Black, J.G. (1999). Microbiology : principles and explorations. Prentice Hall International, London. 4th ed.

12. Kindt, T.J., Goldsby, R.A., Osborne, B.A., and Kuby, J. (2006). Kuby immunology.W.H. Freeman, New York. 6th ed.

13. Forbes, B.A., Sahm, D.F., Weissfeld, A.S., and Bailey, W.R.D. m. (2007). Bailey & Scott's diagnostic microbiologyt. Elsevier, Mosby, London. 12th ed.

MB404 - LAB – 4 Medical Microbiology

PART I - Bacteriology

1. Study of the morphology, staining characters, cultural characters and identification of *Staphylococci, E.coli, Klebsiella, Salmonella, Shigella, Proteus, Pseudomonas, Vibrio,*
2. Isolation and biochemical identification of bacteria from mixed culture.
3. Study of common laboratory contaminants.

PART II - Mycology

1. Culture methods for isolation and identification of fungi- KOH mount preparation,
2. Lactophenol cotton blue staining, Slide culture technique etc.
3. Gram staining and Germ tube test of *Candida albicans*

PART III - Virology and Parasitology

1. Cultivation of viruses in embryonated eggs different routes – harvesting
2. Examination of peripheral blood for haemoflagellates and malarial parasites

PART IV - Clinical Microbiology

1. Study of normal microbial flora of human beings
2. Techniques for collection of clinical specimens for microbiological analysis- Macroscopic, microscopic examination of clinical samples. Culture methods identification and antibiotic sensitivity test of isolates

References

1. Cheesbrough, M. (2006). *District Laboratory Practice in Tropical Countries.*Cambridge University Press.2nd ed.

2. Mackie, T.J., McCartney, J.E., and Collee, J.G. (1989). *Mackie & McCartney practical medical microbiology.* Churchill Livingstone, 13th ed

3. Godkhar,P.B., Darshan,P *Text book of Medical Laboratory Technology* Bhalani Publishers

MB405 - Dissertation And Viva-Voce