

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM
I BSC: MICROBIOLOGY (2018-2019)
CBCS Pattern
SEMESTER-I

Paper I: MBY-111: Introductory Microbiology, Microbial Techniques and Biology of Microorganisms

UNIT-I

- History and Mile stones in Microbiology- Meaning, definition and history of Microbiology.
- Contributions of Antony von Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, Iwanowsky, Beijerinck, Winogradsky and Alexander Fleming.
- Importance and applications of Microbiology.

UNIT-II

- Classification of microorganisms – Hackel's three -kingdom concept – Whittaker's five kingdom concept and three domain concept of Carl Woese and phylogenetic trees. Basis of modern microbial classification and their concepts, nomenclature and taxonomic ranks.
- General characters of Fungi (Yeasts, Candida) – Algae (Cyanobacteria, Chlorella), Protozoa (Entameoba, Leishmania, Plasmodium) microalgae.
- Isolation and identification of Microorganisms- Principles and types of stains (Simple, differential and negative stains), structural stains - spore, capsule, flagella.
- Hanging-drop method.

UNIT-III

- Sterilization and disinfection techniques Principles and methods of sterilization. Physical methods - autoclave, hot-air oven, pressure cooker, laminar air flow, filter sterilization.
- Radiation methods - UV rays, gamma rays, ultrasonic methods. Chemical methods - Use of alcohols, aldehydes, fumigants, phenols, halogens and hypochlorites. Phenol coefficient.

UNIT-IV

- Isolation of pure culture techniques - Enrichment culturing, dilution-plating, streak-plate, spread plate and micromanipulator.
- Preservation of microbial cultures - sub culturing, overlaying cultures with mineral oils, lyophilization, sand cultures, storage at low temperature (ultra low temperature).

UNIT-V

- Differentiation of prokaryotes and eukaryotes. General characteristics of bacteria, archaebacteria, rickettsias, mycoplasmas, cyanobacteria and actinomycetes.
- Outline classification for bacteria as per the second edition of Bergey's Manual of Systematic Bacteriology (up to order level).
- Ultra structure of a bacterial cell: Invariant components - cell wall, cell membrane, ribosomes, nucleoid. Variant components - Capsule, flagella, fimbriae, endospore and storage granules.

- Virology- history, milestones, General characteristics and classification of viruses- animal, plant and microbial. Morphology, structure and replication of TMV, HIV and lambda bacteriophage.

Additional inputs: Principles of Microscopy

Reference Books for Theory papers:

1. Black, J.G. (2005). Microbiology: Principles and Explorations, John Wiley, USA.
2. Tortora, G.J., Funke, B.R. and Case, C.L. (2004). Microbiology: An Introduction. Pearson Education, Singapore.
3. Prescott, M.J., Harley, J.P. and Klein, D.A. (2002). Microbiology. 5th Edition, WCB Mc GrawHill, New York.
4. Dimmock, N.J., Easton, A.J. and Leppard, K.N. (2001). Introduction to Modern Virology, Blackwell Science Ltd, U.K.
5. Madigan, M.T., Martinkl, J.M. and Parker, J. (2000). Brock Biology of Microorganisms, 9th Edition, MacMillan Press, England.

Text Books for Theory papers:

1. Singh, R.P. (2007). General Microbiology. Kalyani Publishers, New Delhi..
2. Ram Reddy, S. and Reddy, S.M. (2007). Essentials of Virology. Scientific Publishers India, Jodhpur.
3. Reddy, S.M. (2003). University Microbiology –I. Golgotha Publications Pvt Ltd., New Delhi.
4. Dube, R.C. and Maheswari, D.K. (2000) General Microbiology. S Chand, New Delhi.

PRACTICAL SYLLABUS

SEMESTER - I

Paper I: Introductory Microbiology, Microbial Techniques and Biology of Microorganisms

1. Precautions to work in Microbiology laboratory.
2. Preparation of culture media: Solid / Liquid.
3. Isolation of single colonies on solid media.
4. Enumeration of bacterial numbers by serial dilution and plating- spread and streak.
5. Light and compound microscope and its handling.
6. Simple and differential staining (Gram's staining).
7. Spore staining, capsule staining and negative staining.
8. Motility of bacteria by Hanging drop method.
9. Contributors of Microbiology- photographs.
10. Electron micrographic representation of viruses-TMV, HIV, Bacteriophages.
11. Physical methods - autoclave, hot-air oven, pressure cooker, laminar air flow, filter sterilization.
12. Microscopic observation of cyanobacteria (*Nostoc*, *Spirulina*), algae (*Scenedesmus* sp Diatoms) and fungi (*Saccharomyces*, *Rhizopus*, *Aspergillus*, *Penicillium*, *Fusarium*).
13. Calibrations of microscopic measurements (Ocular, stage micrometers)- bacteria, fungal spores.

Note: S.No. 5, 6, 7,8,13 practicals are compulsory for major experiments.

References:

1. Benson, J.H. (2005). Microbiological Applications: Laboratory Manual in General Microbiology. 7th Edition, McGraw Hill Publications, New York.
2. Cappuccino, J.G. and Sherman, N. (2005). Microbiology – A Laboratory Manual. 7th Edition. Pearson Education. Published by Dorling Kindersley (India) Pvt. Ltd.
3. Alcamo, I.E. (2001). Laboratory Fundamentals of Microbiology. Jones and Bartlett Publishers, USA.
4. Mahy, B.W.J. and Kangro, H.O. (1996). Virology – Methods Manual. Academic Press, USA.
5. Burlison *et al.* (1992). Virology – A Laboratory Manual. Academic Press, USA
6. Gopal Reddy, M., Reddy, M.N., Saigopal, DVR and Mallaiah, K.V. (2007). Laboratory Experiments in Microbiology, 2nd edition. Himalaya Publishing House, Mumbai.
7. Dubey, R.C. and Maheswari, D.K. (2006). Practical Microbiology, S.Chand & Co., New Delhi.
8. Aneja, K.R. (2001). Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom Production Technology, 3rd Edition, New Age International (P) Ltd, Publishers, New Delhi.
9. Reddy, S.M. and Reddy S.R. (1998). Microbiology – Practical Manual, 3rd Edition, Sri Padmavathi Publications, Hyderabad.

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**II BSC: 3 rd Semester: MICROBIOLOGY****PAPER II: MBY-115: MICROBIAL GENETICS AND MOLECULAR BIOLOGY****UNIT- I:****No. of hours: 10**

- DNA and RNA as genetic material.
- Structure and organization of prokaryotic DNA.
- Extra chromosomal genetic elements – Plasmids and transposons in bacteria.
- Replication of DNA – Semi conservative mechanism, Enzymes involved in replication.

UNIT – II:**No . Of hours: 10**

- Mutations – spontaneous and induced, base pair changes, frame shifts, deletions, inversions, tandem duplications, insertions.
- Mutagens - Physical and Chemical mutagens.
- Outlines of DNA damage and repair mechanisms.
- Genetic recombination in bacteria – Conjugation, Transformation and Transduction.

UNIT-III**No. of hours: 10**

- Types of RNA and their functions.
- Genetic code. Structure of ribosomes.

UNIT-IV**No. of hours: 8**

- Types of genes – structural, constitutive, regulatory
- Protein synthesis – Transcription and translation, regulation of gene expression in bacteria – *lac* operon.

UNIT-V**No. of hours: 10**

- Basic principles of genetic engineering.
- Restriction endonucleases, DNA polymerases and ligases. Vectors like Pbr 322, M13.
- Outlines of gene cloning methods.
- Polymerase chain reaction. Genomic and cDNA libraries.
- General account on application of genetic engineering in industry, agriculture and medicine

REFERENCE BOOK:

- Freifelder, D. (1990). Microbial genetics Narosa Publishing House, New Delhi.
- Freifelder, D. (1997). Essentials of Molecular Biology. Narosa Publishing House, New Delhi.
- Glazer, A.N. and Nikaido, H. (1995). Microbial Biotechnology – Fundamentals of Applied Microbiology, W.H. Freeman and company, New York.
- Glick, B.P. and Pasternack, J. (1998). Molecular Biotechnology, ASM Press, Washington D.C., USA.
- Verma, P.S. and Agarwal, V.K. (2004). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand & Co. Ltd., New Delhi. Washington, D.C., USA
Lewin, B. (2000). Genes VIII. Oxford University Press, England

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**II B.Sc: MICROBIOLOGY - SEMESTER-III****PAPER-II: Microbial genetics and molecular biology****Practical syllabus (2018-19)**

1. Study of different types of DNA and RNA using micrographs and model / schematic representations
2. Study of semi-conservative replication of DNA through micrographs / schematic representations
3. Isolation of genomic DNA from *E. coli*
4. Estimation of DNA using UV spectrophotometer.
5. Resolution and visualization of DNA by Agarose Gel Electrophoresis.
6. Resolution and visualization of proteins by Polyacrylamide Gel Electrophoresis (SDS- PAGE).
7. Problems related to DNA and RNA characteristics, Transcription and Translation.
8. Induction of mutations in bacteria by UV light.
9. Instrumentation in molecular biology – Ultra centrifuge, Transilluminator, PCR

Additional input: Fermentation of Alcohol

REFERENCE BOOKS FOR LAB:

- Nicholl, D.S.T. (2004). An Introduction to Genetic Engineering. 2 nd Edition. Cambridge University Press, London.
- Snyder, L. and Champness, W. (1997). Molecular Genetics of Bacteria. ASM press, Strickberger, M.W. (1967). Genetics. Oxford & IBH, New Delhi
- Kannan, N. (2003). Hand Book of Laboratory Culture Medias, Reagents, Stains and Buffers. Panima Publishing Co., New Delhi

GOVERNMENT COLLEGE (A) RAJAMAHENDRAVARAM
III B.Sc MICROBIOLOGY (CBCS) SYLLABUS
SEMESTER- V, PAPER – III

MBY – 126 : ENVIRONMENTAL & AGRICULTURAL MICROBIOLOGY

TOTAL HOURS: 36

CREDITS: 3

UNIT – I

No. of hours: 8

- Terrestrial Environment: Soil profile and soil micro flora
- Aquatic Environment: Micro flora of fresh water and marine habitats Atmosphere: Aero micro flora and dispersal of microbes

UNIT – II

No. of hours: 8

- Role of microorganisms in nutrient cycling (Carbon, nitrogen, phosphorus).
- Treatment and safety of drinking (potable) water, methods to detect potability of water samples: (a) standard qualitative procedure: presumptive test/MPN test, confirmed and completed tests for fecal coli forms (b) Membrane filter technique. Microbial interactions – mutualism, commensalism, antagonism, competition, parasitism, predation.

UNIT – III

No. of hours: 6

- Outlines of Solid Waste management: Sources and types of solid waste, Methods of solid waste disposal (composting and sanitary landfill).
- Liquid waste management: Composition and strength of sewage (BOD and COD), Primary, secondary (oxidation ponds, trickling filter, activated sludge process and septic tank) and tertiary sewage treatment.

UNIT – IV

No. of hours: 7

- Plant Growth Promoting Microorganisms - Mycorrhizae, Rhizobia, *Azospirillum*, *Azotobacter*, *Frankie*,
- Phosphate- solubilizers and Cyanobacteria.
- Outlines of biological nitrogen fixation (symbiotic, non-symbiotic). Biofertilizers - *Rhizobium*.

UNIT – V

No. of hours: 7

- Concept of disease in plants. Symptoms of plant diseases caused by fungi, bacteria, and viruses. Plant diseases - groundnut rust, Citrus canker and tomato leaf curl.
- Principles of plant disease control.

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM

III B.Sc : MICROBIOLOGY - SEMESTER-V

PAPER-III : ENVIRONMENTAL & AGRICULTURAL MICROBIOLOGY

Practical syllabus (2018-19)

TOTAL HOURS: 36

CREDITS: 2

1. Preparation of soil extract agar and any one culture media for algal growth
2. Isolation of microbes (bacteria and fungi) from soil.
3. Study of air micro flora by petriplate exposure method.
4. Microbiological Analysis of potable water Standard Plate Count
5. Determination of Dissolved Oxygen (DO) of water samples.
6. Isolation of *Rhizobium* from root nodules.
7. Isolation of actinomycetes on I.S.P. media (International Streptomyces project media)
8. Observation of photo micrographs of plant diseases of local importance - Citrus canker, Tikka disease of Groundnut, Bhendi yellow vein mosaic, Rusts, Smuts, Powdery mildews, Tomato leaf curl.

SUGGESTED READINGS

- Atlas RM and Bartha R. (2000). Microbial Ecology: Fundamentals & Applications. 4th edition. Benjamin/Cummings Science Publishing, USA
- Barton LL & Northup DE (2011). Microbial Ecology. 1st edition, Wiley Blackwell, USA
- Campbell RE. (1983). Microbial Ecology. Blackwell Scientific Publication, Oxford, England.
- Coyne MS. (2001). Soil Microbiology: An Exploratory Approach. Delmar Thomson Learning.
- Lynch JM & Hobbie JE. (1988). Microorganisms in Action: Concepts & Application in Microbial Ecology. Blackwell Scientific Publication, U.K.
- Madigan MT, Martinko JM and Parker J. (2014). Brock Biology of Microorganisms. 14th edition. Pearson/ Benjamin Cummings
- Maier RM, Pepper IL and Gerba CP. (2009). Environmental Microbiology. 2nd edition, Academic Press
- Martin A. (1977). An Introduction to Soil Microbiology. 2nd edition. John Wiley & Sons Inc. New York & London.
- Okafor, N (2011). Environmental Microbiology of Aquatic & Waste systems. 1st edition, Springer, New York.
- Singh A, Kuhad, RC & Ward OP (2009). Advances in Applied Bioremediation. Volume 17, Springer- Verlag, Berlin Hedeilberg

GOVERNMENT COLLEGE (A) RAJAMAHENDRAVARAM
III B.Sc MICROBIOLOGY (CBCS) SYLLABUS
SEMESTER- V, PAPER – IV

MBY - 117 : FOOD AND INDUSTRIAL MICROBIOLOGY

TOTAL HOURS: 36

CREDITS: 3

UNIT-I

No. of hours: 8

- Intrinsic and extrinsic parameters that affect microbial growth in food
- Microbial spoilage of food - fruits, vegetables, milk, meat, egg, bread and canned foods Food intoxication (botulism).
- Food-borne diseases (salmonellosis) and their detection.

UNIT – II

No. of hours: 7

- Principles of food preservation - Physical and chemical methods. Fermented Dairy foods – cheese and yogurt.
- Microorganisms as food – SCP, edible mushrooms (white button, oyster and paddy straw). Probiotics and their benefits.

UNIT – III

No. of hours: 6

- Microorganisms of industrial importance – yeasts,(*Saccharomyces cerevisiae*) moulds,(*Aspergillus niger*) Bacteria(*E.coli*), actinomycetes (*Streptomyces griseus*).
- Outlines of Isolation and Screening and strain improvement of industrially-important microorganisms.

UNIT – IV

No. of hours: 8

- Types of fermentation processes – solid state, liquid state, batch, fed-batch, continuous. Basic concepts of Design of Fermentor.
- Ingredients of Fermentation media
- Downstream processing - filtration, centrifugation, cell disruption, solvent extraction.

UNIT – V

No. of hours: 7

- Microbial production of Industrial products - Citric acid, Ethanol, amylases, penicillin, glutamic acid and vitamin B12.
- Additional input: Recycling of industrial wastes

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**III B.Sc: MICROBIOLOGY - SEMESTER-V****PAPER-IV: FOOD AND INDUSTRIAL MICROBIOLOGY****Practical syllabus (2018-19)****TOTAL HOURS: 36****CREDITS: 2**

1. Isolation of bacteria and fungi from spoiled bread/fruits/vegetables
2. Preparation of Yogurt/Dahi
3. Determination of the microbiological quality of milk sample by MBRT
4. Isolation of antagonistic microorganisms by crowded plate technique
5. Design of Fermenter(identification of diagrams of various types of Fermentors and labeling of parts)
6. Microbial fermentation for the production and estimation of ethanol from Grapes.
7. Microbial fermentation for the production and estimation of citric acid.
8. **Additional inputs:** Survey of food industries in East Godavari

SUGGESTED READING

- Adams MR and Moss MO. (1995). Food Microbiology. 4th edition, New Age International (P) Limited Publishers, New Delhi, India.
- Banwart JM. (1987). Basic Food Microbiology. 1st edition. CBS Publishers and Distributors, Delhi, India.
- Casida LE. (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited.
- Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd Edition. Panima Publishing Company, New Delhi
- Frazier WC and Westhoff DC. (1992). Food Microbiology. 3rd edition. Tata McGraw-Hill Publishing Company Ltd, New Delhi, India.
- Jay JM, Loessner MJ and Golden DA. (2005). Modern Food Microbiology. 7th edition, CBS Publishers and Distributors, Delhi, India
- Patel AH. (1996). Industrial Microbiology .1st Edition. MacMillan India Limited Publishing Company Ltd. New Delhi, India

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM

I BSC: MICROBIOLOGY (2018 – 2019)

II Semester Syllabus

MBY – 112: MICROBIAL BIOCHEMISTRY & METABOLISM

UNIT-I:

No. of hours: 10 Hrs

- Outline classification and general characteristics of carbohydrates (monosaccharides, disaccharides and polysaccharides).
- General characteristics of amino acids and proteins.
- Structure of nitrogenous bases, nucleotides, nucleic acids.
- Fatty acids (saturated and unsaturated)
- Lipids (spingolipds, sterols and phospholipids).

UNIT-II:

No. of hours : 8 Hrs

- Principle and applications of Colorimerty, Chromatography (paper, thin-layer and column), Spectrophotometry (UV & visible), Centrifugation and Gel Electrophoresis.

UNIT-III:

No. of hours: 10 Hrs

- Properties and classification of Enzymes.
- Biocatalysis- induced fit and lock and key models.
- Coenzymes and Cofactors.
- Factors affecting catalytic activity.
- Inhibition of enzyme activity- competitive, noncompetitive, uncompetitive and allosteric.

UNIT-IV:

No. of hours: 10 Hrs

- Microbial Nutrition –Nutritional requirements and uptake of nutrients by cells.
- Nutritional groups of microcroorganisms- autotrophs, heterotrophs, and mixotrophs.
- Growth media- synthetic, complex, selective, enrichment and differential media.
- Microbial Growth- different phases of growth in batch cultures, Synchronous, continuous, biphasic growth.
- Factors influencing microbial growth.
- Methods for measuring microbial growth – Direct microscopy, viable count estimates, turbidometry and biomass.

UNIT-V:

No. of hours: 10 Hrs

- Aerobic respiration -Glycolysis, HMP path way, ED path way, TCA cycle, Electron transport, oxidative and substrate level phosphorylation.
- Anaerobic respiration (Nitrate).
- Fermentation - Alcohol and lactic acid fermentations.
- Outlines of oxygenic and an oxygenic photosynthesis in bacteria.

PRACTICAL SYLLABUS
MICROBIAL BIOCHEMISTRY & METABOLISM
SEMESTER - II

1. Qualitative Analysis of Carbohydrates
2. Qualitative Analysis of Amino acids
3. Colorimetric estimation DNA by diphenylamine method
4. Colorimetric estimation of proteins by Biuret/Lowry method.
5. Paper chromatographic separation of sugars and amino acids.
6. Preparation of different media- Synthetic and Complex Media.
7. Setting and observation of Winogradsky column.
8. Estimation of CFU count by spread plate method/pour plate method.
9. Bacterial growth curve.
10. Factors affecting bacterial growth – PH.
11. Factors affecting bacterial growth – Temperature.
12. Factors affecting bacterial growth –Salts.

SUGGESTED READINGS

1. Berg JM, Tymoczko JL and Stryer L (2011) **Biochemistry**, W.H.Freeman and Company
2. Caldwell, D.R. (1995). **Microbial Physiology and Metabolism**, W.C. Brown Publications, Iowa, USA.
3. Campbell, PN and Smith AD (2011) **Biochemistry** Illustrated, 4th ed., Published by Churchill Livingstone
4. Elliot, W.H. and Elliot, D.C. (2001). **Biochemistry and Molecular Biology**, 2 nd Edition, Oxford University Press, U.S.A.
5. Gottschalk, G. (1986). **Bacterial Metabolism**, SpringerVerlag, New York.

6. Lehninger, A.L., Nelson, D.L. and Cox, M.M. (1993). **Principles of Biochemistry**, 2nd Edition, CBS Publishers and Distributors, New Delhi.
7. Madigan, M.T., Martinkl, J.M. and Parker, J. (2010). **Brock Biology of Microorganisms**, 9th Edition, MacMillan Press, England.
8. Moat, A.G. and Foster, J.W. (1995). **Microbial Physiology**, John Wiley, New York.
9. Nelson DL and Cox MM (2008) Lehninger **Principles of Biochemistry**, 5th Edition. W.H. Freeman and Company.
10. Prescott, M.J., Harley, J.P. and Klein, D.A. (2010). **Microbiology**. 5th Edition, WCB Mc Graw Hill, New York.
11. Reddy, S.R. and Reddy, S.M. (2004). **Microbial Physiology**, Scientific Publishers, Jodhpur, India.
12. Sashidhara Rao, B. and Deshpande, V. (2007). **Experimental Biochemistry: A student Companion**. I.K. International Pvt. Ltd.
13. Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. (1991). **General Microbiology**, 5th Ed. Prentice Hall of India Pvt. Ltd., New Delhi.
14. Tymoczko JL, Berg JM and Stryer L (2012) **Biochemistry: A short course**, 2nd ed., W.H. Freeman
15. Voet, D. and Voet J.G (2004) **Biochemistry** 3rd edition, John Wiley and Sons

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM

II BSC; MICROBIOLOGY

MBY– 116: IMMUNOLOGY AND MEDICAL MICROBIOLOGY

Semester – 4, Syllabus (2018-19)

TOTAL HOURS: 48

CREDITS: 4

UNIT – I:

No. of hours : 10

- Types of immunity – innate and acquired; active and passive; humoral and cell-mediated immunity.
- Primary and secondary organs of immune system – thymus, bursa fabricus, bone marrow, spleen and lymph nodes.
- Cells of immune system.
- Identification and function of B and T lymphocytes, null cells, monocytes, macrophages, neutrophils, basophiles and eosinophils.

UNIT – II :

No. of hours : 10

- Antigens – types, chemical nature, antigenic determinants, haptens. Factors affecting antigenicity.
- Antibodies – basic structure, types, properties and functions of immunoglobulins.
- Types of antigen-antibody reactions - Agglutinations, Precipitation, Neutralization, complement fixation, blood groups.
- Labeled antibody based techniques – ELISA, RIA and Immunofluorescence.
- Monoclonal antibodies – production and applications.
- Concept of hypersensitivity and Autoimmunity.

UNIT – III :

No. of hours :10

- Normal flora of human body.
- Host pathogen interactions: infection, invasion, pathogen, pathogenicity, virulence and opportunistic infection, General account on nosocomial infection.
- General principles of diagnostic microbiology- collection, transport and processing of clinical samples.
- General methods of laboratory diagnosis - cultural, biochemical, serological and molecular methods.

UNIT – IV :**No. of hours : 8**

- Antibacterial Agents- Penicillin, Streptomycin and Tetracycline.
- Antifungal agents – Amphotericin B, Griseofulvin
- Antiviral substances - Amantadine and Acyclovir
- Tests for antimicrobial susceptibility.
- Brief account on antibiotic resistance in bacteria - Methicillin-resistant Staphylococcus aureus (MRSA).
- Vaccines – Natural and recombinant

UNIT – V :**No. of hours : 10**

- General account on microbial diseases – causal organism, pathogenesis, epidemiology, diagnosis, prevention and control
- Bacterial diseases – Tuberculosis and Typhoid
- Fungal diseases – Candidiasis.
- Protozoal diseases – Malaria.
- Viral Diseases - Hepatitis- A and AIDS

Text and reference books:

- Abbas AK, Lichtman AH, Pillai S. (2007). **Cellular and Molecular Immunology**. 6th edition Saunders Publication, Philadelphia.
- Ananthanarayan R. and Paniker C.K.J. (2009) **Textbook of Microbiology**. 8th edition, University Press Publication
- Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's **Medical Microbiology**. 26th edition. McGraw Hill Publication
- Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's **Essential Immunology**. 11th edition Wiley-Blackwell Scientific Publication, Oxford.
- Kuby's **Immunology**. 6th edition W.H. Freeman and Company, New York.
- Jawetz, Melnick and Adelberg's **Medical Microbiology**. 26th edition. McGraw Hill Microbiology. 4th edition. Elsevier Publication

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**II BSC; MICROBIOLOGY- SEMESTER-IV****PAPER-II: Immunology and medical microbiology****Practical Syllabus (2018-19)**

1. Identification of human blood groups.
2. Separate serum from blood sample (demonstration).
3. Estimation of blood haemoglobin.
4. Total leukocyte count of the given blood sample.
5. Differential Leukocyte Count of the given blood sample.
6. Immuno diffusion by Ouchterlony method.
7. Identify bacteria (*E.coli*, *Pseudomonas*, *Staphylococcus*, *Bacillus*) using laboratory strains on the basis of cultural, morphological and biochemical characteristics: IMViC, urease production and catalase tests.
8. Isolation of bacterial flora of skin by swab method.
9. Antibacterial sensitivity by Kirby-Bauer method.
10. Study symptoms of the diseases with the help of photographs: Anthrax, Polio, Herpes, Chicken pox, HPV warts, Dermatomycoses (ring worms).
11. Study of various stages of malarial parasite in RBCs using permanent mounts.

REFERENCE BOOKS FOR LAB:

- Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' **Medical Microbiology**. 4th edition. Elsevier
- Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's **Immunology**. 6th edition W.H. Freeman and Company, New York.

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM

III B.Sc MICROBIOLOGY (CBCS) SYLLABUS

IV- SEMESTER -PAPER- VII (Elective – 1)

MBY - 127: MICROBIAL BIOTECHNOLOGY

TOTAL HOURS: 36

CREDITS: 3

UNIT- I

No. of Hours: 8

- Microbial biotechnology: Scope and its applications in human therapeutics, agriculture (Biofertilizers, PGPR, Mycorrhizae), environmental, and food technology.
- Genetically engineered microbes for industrial application: Bacteria and yeast

UNIT- II

No. of Hours: 7

- Recombinant microbial production processes in pharmaceutical industries - Streptokinase, recombinant vaccines (Hepatitis B vaccine).
- Over view of production and applications of Microbial polysaccharides, Bioplastics and Microbial biosensors

UNIT- III

No. of Hours: 10

- Microbial based transformation of steroids and sterols.
- Bio-catalytic processes and their industrial applications: Production of high fructose syrup and production of cocoa butter substitute.
- Immobilization methods and their application: Whole cell immobilization

UNIT- IV

No. of Hours: 7

- Bio-ethanol and bio-diesel production: commercial production from lignocellulosic waste and algal biomass.
- Biogas production: Methane and hydrogen production using microbial culture. Microorganisms in bioremediation: Degradation of xenobiotics.
- Mineral recovery, removal of heavy metals from aqueous effluents.

UNIT- V

No. of Hours: 4

- Outlines of Intellectual Property Rights: Patents, Copyrights, Trademarks

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**III BSC; MICROBIOLOGY- SEMESTER-V****MICROBIAL BIOTECHNOLOGY****Practical Syllabus (2018-19)****TOTAL HOURS: 36****CREDITS: 2**

1. Yeast cell immobilization in calcium alginate gels
2. Enzyme immobilization by sodium alginate method
3. Pigment production from fungi (Trichoderma / Aspergillus / Penicillium)
4. Isolation of xylanase or lipase producing bacteria
5. Study of algal Single Cell Proteins

SUGGESTED READING

1. Crueger W, Crueger A (1990) **Biotechnology: A text Book of Industrial Microbiology** 2nd edition Sinauer associates, Inc.
2. Demain, A. L and Davies, J. E. (1999). **Manual of Industrial Microbiology and Biotechnology**, 2nd Edition, ASM Press.
3. Glazer AN and Nikaido H (2007) **Microbial Biotechnology**, 2nd edition, Cambridge University Press Glick BR, Pasternak JJ, and Patten CL (2010) **Molecular Biotechnology** 4th edition, ASM Press Gupta PK (2009) **Elements of Biotechnology** 2nd edition, Rastogi Publications
4. Prescott, Harley and Klein's **Microbiology** by Willey JM, Sherwood LM, Woolverton CJ (2014), 9th edition, Mc Graw Hill Publishers.
5. Ratledge, C and Kristiansen, B. (2001). **Basic Biotechnology**, 2nd Edition, Cambridge University Press.
6. Stanbury PF, Whitaker A, Hall SJ (1995) **Principles of Fermentation Technology** 2nd edition., Elsevier Science
7. Swartz, J. R. (2001). **Advances in Escherichia coli production of therapeutic proteins. Current Opinion in Biotechnology**, 12, 195–201.

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM
III B.Sc MICROBIOLOGY (CBCS) SYLLABUS
VI – SEMESTER – PAPER- VII (Elective – 2)

MBY – 128: ADVANCES IN MICROBIOLOGY

TOTAL HOURS: 36

CREDITS:3

UNIT- I

No. of Hours:8

- Salient features of sequenced microbial genomes, core genome pool, flexible genome pool and concept of pangenome. Evolution of bacterial virulence - Genomic islands, Pathogenicity islands (PAI) and their characteristics.

UNIT- II

No. of Hours: 8

- Brief history and development of Metagenomics. Understanding bacterial diversity using metagenomics approach. Prospecting genes of biotechnological importance using metagenomics. Basic knowledge of viral metagenome, metatranscriptomics, metaproteomics and metabolomics

UNIT- III

No. of Hours: 8

- Epiphytic fitness and its mechanism in plant pathogens. Hypersensitive response (HR) to plant pathogens and its mechanism. Type three secretion systems (TTSS) of plant and animal pathogens.

UNIT - IV

No. of Hours: 5

- Biofilms: Types of microorganisms, molecular aspects and significance in environment, health care, virulence and antimicrobial resistance

UNIT.V

No. of Hours: 7

- Networking in biological systems, Quorum sensing in bacteria. Co-ordinated regulation of bacterial virulence factors. Basics of synthesis of poliovirus in laboratory. Future implications of synthetic biology with respect to bacteria and viruses.

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM

III BSC; MICROBIOLOGY- SEMESTER-VI

ADVANCES IN MICROBIOLOGY

Practical Syllabus (2018-19)

TOTALHOURS: 36

CREDITS:2

1. Extraction of metagenomic DNA from soil
2. To understand the impediments in extracting metagenomic DNA from soil
3. PCR amplification of metagenomic DNA using universal 16s ribosomal gene primers
4. Case study to understand how the poliovirus genome was synthesized in the laboratory
5. S. Case study to understand how networking of metabolic pathways in bacteria takes place

SUGGESTED READING :

1. Fraser CM, Read TD and Nelson KE. Microbial Genomes, 2004, Humana Press
2. Miller RV and Day MJ. Microbial Evolution- Gene establishment, survival and exchange, 2004, ASM Press
3. Bull AT. Microbial Diversity and Bioprospecting, 2004, ASM Press.
4. Sangdun C. Introduction to Systems Biology, 2007, Humana Press
5. Klipp E, Liebermeister W. Systems Biology - A Textbook, 2009, Wiley - VCH Verlag
6. Caetano-Anolles G. Evolutionary Genomics and Systems Biology, 2010, John Wiley and Sons
7. Madigan MT, Martink JM, Dunlap PV and Clark DP (2014) Brook's Biology of Microorganisms, 14th edition, Pearson-Benjamin Cummings
- Wilson BA, Salyers AA Whitt DD and Winkler ME (2011) Bacterial Pathogenesis- A molecular Approach, 3rd edition, ASM Press,
8. Bouarab K, Brisson and Daayf F (2009) Molecular Plant-Microbe interaction CAB International.
9. Voit Eo (2012) A First Course in Systems Biology, 1st edition, Garland Science

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM**III B.Sc MICROBIOLOGY (CBCS) SYLLABUS****VI - SEMESTER –PAPER 8A****CLUSTER PAPERS UNDER ELECTIVE (8A1, 8A2 & 8A3)****MBY -119: 8A1 - DIAGNOSTIC MICROBIOLOGY****TOTAL HOURS: 36****CREDITS: 3****UNIT- I****No. of hours: 8**

- Study of Bacterial,(Tuberculosis and Typhoid) Viral,(Influenza and HIV) Fungal (Aspergillosis and Candidiasis)and Protozoan Malaria and Amebiasis)Diseases affecting humans.

UNIT- II**No. of hours: 8**

- Collection of clinical samples (oral cavity, throat, skin, blood, CSF, urine and faeces) and precautions required.
- Method of transport of clinical samples to laboratory and storage.

UNIT- III**No. of hours: 8**

- Examination of sample by staining - Gram stain, Ziehl-Neelson staining for tuberculosis, Giemsa-stained thin blood film for malaria
- Preparation and use of culture media - Blood agar, Chocolate agar, Lowenstein-Jensen medium, MacConkey agar, Distinct colony properties of various bacterial pathogens.

UNIT- IV**No. of hours: 6**

- Serological Methods - Agglutination, ELISA, immunofluorescence, Nucleic acid based methods - PCR, Nucleic acid probes.
- Typhoid, Dengue and HIV, Swine flu.

UNIT- V**No. of hours: 6**

- Importance, Determination of resistance/sensitivity of bacteria using disc diffusion method, Determination of minimal inhibitory concentration (MIC) of an antibiotic by serial double dilution method

8A1 - DIAGNOSTIC MICROBIOLOGY PRACTICALS

TOTAL HOURS: 36

CREDITS: 2

1. Collection transport and processing of any one of the following clinical specimens (Blood/ Urine/ Stool/Sputum). Receipts, Labeling, recording and dispatching clinical specimens.
2. Isolation of bacteria in pure culture and Antibiotic sensitivity.
3. Identification of common bacteria (E.coli, Staphylococcus aureus and Streptococcus sps) by studying their morphology, cultural character, Biochemical reactions, and other tests.
4. Maintenance and preservation of stock culture.

SUGGESTED READING

1. Ananthanarayan R and Paniker CKJ (2009) **Textbook of Microbiology**, 8th edition, Universities Press Private Ltd.
2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's **Medical Microbiology**. 26th edition. McGraw Hill Publication
3. Collee JG, Fraser, AG, Marmion, BP, Simmons A (2007) Mackie and McCartney Practical **Medical Microbiology**, 14th edition, Elsevier.
4. Randhawa, VS, Mehta G and Sharma KB (2009) **Practicals and Viva in Medical Microbiology** 2nd edition, Elsevier India Pvt Ltd
5. Tille P (2013) Bailey's and Scott's **Diagnostic Microbiology**, 13th edition, Mosby

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM

III B.Sc MICROBIOLOGY (CBCS) SYLLABUS

VI - SEMESTER

**MBY -122: 8A2 - MICROBIAL QUALITY CONTROL IN FOOD AND
PHARMACEUTICAL INDUSTRIES**

TOTAL HOURS: 36

CREDITS: 3

UNIT – I

No of Hours: 8

- Good laboratory practices - Good microbiological practices.
- Biosafety cabinets – Working of biosafety cabinets, using protective clothing, specification for BSL-1, BSL-2, BSL-3.
- Discarding biohazardous waste – Methodology of Disinfection, Autoclaving & Incineration

UNIT – II

No. of Hours: 8

- Culture and microscopic methods - Standard plate count, Most probable numbers, Direct microscopic counts,
- Biochemical and immunological methods: Limulus lysate test for endotoxin, gel diffusion, sterility testing for pharmaceutical products

UNIT – III

No. of Hours: 8

- Molecular methods - Nucleic acid probes, PCR based detection, biosensors.

UNIT – IV

No. of Hours: 8

- Enrichment culture technique, Detection of specific microorganisms - on XLD agar, Salmonella Shigella Agar, Manitol salt agar, EMB agar, McConkey Agar, Sabouraud Agar
- Ascertaining microbial quality of milk by MBRT, Rapid detection methods of microbiological quality of milk at milk collection centres (COB, 10 min Resazurin assay).

UNIT – V

No. of Hours: 4

- Hazard analysis of critical control point (HACCP) - Principles, flow diagrams, limitations.
- Microbial Standards for Different Foods and Water – BIS standards for common foods and drinking water.

8A2 - MICROBIAL QUALITY CONTROL IN FOOD AND PHARMACEUTICAL INDUSTRIES

PRACTICALS

TOTAL HOURS: 36

CREDITS: 2

1. Microbiological laboratory safety- General rules & Regulations.
2. Sterility tests for Instruments – Autoclave & Hot Air Oven
3. Disinfection of selected instruments & Equipments
4. Sterility of Air and its relationship to Laboratory & Hospital sepsis.
5. Sterility testing of Microbiological media
6. Sterility testing of any one Pharmaceutical product
7. Standard qualitative analysis of water.
8. Microbiological analysis of homogenized food samples by direct microscopic count

SUGGESTED READING

1. Baird RM, Hodges NA and Denyer SP (2005) Handbook of Microbiological Quality control in Pharmaceutical and Medical Devices, Taylor and Francis Inc.
2. Garg N, Garg KL and Mukerji KG (2010) Laboratory Manual of Food Microbiology I K International Publishing House Pvt. Ltd.
3. Harrigan WF (1998) Laboratory Methods in Food Microbiology, 3rd ed. Academic Press
4. Jay JM, Loessner MJ, Golden DA (2005) Modern Food Microbiology, 7th edition. Springer
5. Laboratory Exercises in Microbiology, George.A.Wistreich & Max.D.Lechtman, 3 rd Ed, Glencoe press, London.
6. Manual of diagnostic microbiology, Dr.B.J.Wadher & Dr.G.L.Bhoosreddy, Firs.Ed., Himalaya publishing house, Nagpur.
7. Microbiology - A laboratory manual, Cappuccino & Sherman , 6 th Ed, Pearson Education Pharmaceutical Microbiology – Purohit
8. Pharmaceutical Microbiology – W.B. Hugo

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM**III B.Sc MICROBIOLOGY (CBCS) SYLLABUS****VI - SEMESTER****MBY -121: 8A3 - BIOFERTILIZERS AND BIOPESTICIDES****TOTAL HOURS: 36****CREDITS: 3****UNIT – I****No of Hours: 10**

- General account of the microbes used as biofertilizers for various crop plants and their advantages over chemical fertilizers.
- Symbiotic N₂ fixers: Rhizobium - Isolation, characteristics, types, inoculum production and field application, legume/pulses plants
- Frankia from non-legumes and characterization.
- Cyanobacteria and Azolla, characterization, mass multiplication, Role in rice cultivation, Crop response, field application.

UNIT – II**No of Hours: 6**

- Free living Azospirillum, Azotobacter - isolation, characteristics, mass inoculum production and field application.

UNIT – III**No of Hours: 6**

- Phosphate solubilizing microbes - Isolation, characterization, mass inoculum production, field application

UNIT – IV**No of Hours: 7**

- Importance of mycorrhizal inoculum, types of Mycorrhizae and associated plants, Mass inoculum production of VAM, field applications of Ectomycorrhizae and VAM.

UNIT – V**No of Hours: 7**

- General account of microbes used as bioinsecticides and their advantages over synthetic pesticides. Bacillus thuringiensis - production, Field applications.
- Viruses – NPV cultivation and field applications.

8A3 - BIOFERTILIZERS AND BIOPESTICIDES**PRACTICALS****TOTAL HOURS: 36****CREDITS: 2**

1. Isolation of Rhizobium from root nodules.
3. Isolation of phosphate solubilizers from soil
4. Staining and observation of VAM
3. A visit to biofertilizer production unit.

SUGGESTED READINGS

1. Agarwal SK (2005) **Advanced Environmental Biotechnology**, APH publication.
2. Kannaiyan, S. (2003). **Biotechnology of Biofertilizers**, CHIPS, Texas.
3. Mahindra K. Rai (2005). **Hand book of Microbial biofertilizers**, The Haworth Press, Inc. New York. Reddy, S.M. et. al.(2002). **Bioinoculants for sustainable agriculture and forestry**, Scientific Publishers.
4. Saleem F and Shakoori AR (2012) **Development of Bioinsecticides**, Lap Lambert Academic Publishing GmbH KG
5. Subba Rao N.S (1995) **Soil microorganisms and plant growth** Oxford and IBH publishing co. Pvt. Ltd.

New Delhi.

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM**III B.Sc MICROBIOLOGY (CBCS) SYLLABUS****6th - SEMESTER –PAPER 8B****CLUSTER PAPERS UNDER ELECTIVE (8B1, 8B2 & 8B3)****MBY -120: 8B1 - Microbes in Sustainable Agriculture****TOTALHOURS: 36****CREDITS: 3****UNIT – I:****No of Hours 8**

- Soil as Microbial Habitat, soil properties. Diversity and distribution of Microorganisms in soil. Mineralization of cellulose, hemicelluloses, lignin, Phosphate, nitrate.

UNIT - II:**No of Hours 6**

- Carbon dioxide, methane, nitrous oxide, nitric oxide -production and control

UNIT – III:**No of hours 6**

- Biocontrol mechanisms - Microorganisms used as Biocontrol agents against Microbial plant pathogens, Insects, Weeds.

UNIT - IV:**No of Hours: 8**

- plant growth promoting bacteria, biofertilizers - symbiotic (Bradirhizobium, Rhizobium, Frankia), Non symbiotic (Azospirillum, Azotobacter, Mycorrhizae, MHBs, phosphate solubilizers, algae).
- Novel combination of microbes as biofertilizers, PGPRs

UNIT – V:**No of Hours: 8**

- Biotech feed, silage, Biomanure, biogas, biofuels - advantages and processing parameters. Advantages,
- Social and environmental aspects of GM crops, BT crops, golden rice, transgenic animals.

8B1 - MICROBES IN SUSTAINABLE AGRICULTURE PRACTICALS

TOTAL HOURS: 36

CREDITS: 2

1. Study of soil Profile.
2. Study of micro flora of different types of soils.
3. Rhizobium as soil inoculants characteristics and field application.
4. Azotobacter as soil inoculants characteristics and field application.
5. Design and functioning of a biogas plant.
6. Isolation of cellulose degrading organisms.

SUGGESTED READINGS

1. Agrios GN. (2006). Plant Pathology. 5th edition. Academic press. San Diego.
2. Singh RS (1998). Plant Diseases Management. 3rd edition. Oxford & IBH. New Delhi.
3. Sambrook J, Fritsch EF, Maniatis T (2001) Molecular Cloning: Laboratory Manual, 2nd edition, ASM Press,
4. Atlas RM and Bartha R. (2000) Microbial Ecology: Fundamentals & Applications, 2nd edition, Benjamin/Cummings Science Publishing, USA
5. Maier RM, Pepper IL and Gerba CP. (2009). Environmental Microbiology. 2nd edition, Academic Press
6. Barton LL & Northup DE (2011). Microbial Ecology. 1st edition, Wiley Blackwell, USA
7. Campbell RE. (1933). Microbial Ecology. Blackwell Scientific Publication, Oxford, England.
8. S. Coyne MS. (2001). Soil Microbiology: An Exploratory Approach. Delmar Thomson Learning.
9. Altman A (1998). Agriculture Biotechnology, 1st edition, Marcel dekker Inc.
10. Mahendra K. Rai (2005).
11. Hand Book of Microbial Biofertilizers, The International Journal of Microbiology
12. Bioinoculants for Sustainable Agriculture and Food Security. F and Shalioori AR (2012) Development of Bioinsecticide, Lap Lambert Academic Publishing GmbH KG

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM
III B.Sc MICROBIOLOGY (CBCS) SYLLABUS
VI – SEMESTER – PAPER 8B
MBY – 129: 8B2 - MUSHROOM CULTTVATION

TOTAL HOURS: 36

CREDITS: 3

UNIT – I

No of Hours: 8

- History and scope of mushroom cultivation. Types of edible mushrooms Available in India. Mushroom morphology. Different parts of a typical Mushroom & variations in mushroom morphology. Button, Paddy straw & Oyster- General Morphology, distinguishing characteristics.

UNIT - II

No of Hours: 6

- Classification Based on occurrence, natural habitats, color of spores, Morphology of fruiting layers, Structure and texture of fruiting bodies. Key to Differentiate edible from Poisonous mushrooms. Economic importance of edible Mushrooms.

UNIT - III

No of Hours: 10

- Cultivation of Button, Oyster and Paddy straw Mushrooms: Collection of raw Materials, compost & composting, spawn & spawning, casing & case run, Cropping, picking & packing, marketing.

UNIT – IV

No of Hours: 6

- Nutritional profile of mushrooms, health benefits of mushrooms. Mushroom Toxins and illness, mushroom recipes.

UNIT - V

No of Hours: 6

- Effect of physical and chemical factors on the growth of mushrooms. crop Management during spawn running, casing to mushroom period, the cropping Period. Post harvest management.

**8B2 - MUSHROOM CULTIVATION
PRACTICAL**

TOTAL HOURS: 36

CREDITS: 2

1. Microscopic and anatomical observations of different mushroom species. .
2. Preparation of spawn under controlled conditions (preparation of mother
Spawn in saline bottle and polypropylene bag and their multiplication
3. Types of Compost preparation and sterilization.
4. Mushroom bed preparation - paddy straw, sugarcane trash, maize
Straw, banana leaves/waste.
5. Spawning, casing, Cropping and harvesting.
6. Substrate preparation, bed preparation, spawning and cropping.
7. Diseases of mushrooms (photographs).
8. Visit to relevant Labs/Field Visits

SUGGESTED READINGS

1. Mushroom Cultivation, Tripathi, D.P.(2005) Oxford & IBH Publishing Co. PVT.LTD, New Delhi.
2. Mushroom Production and Processing Technolory, Pathak Yadav Gour (2010) Published by Agrobios (India).
3. A hand book of edible mushroom, S.Kannaiyan& K.Ramasamy (1980). Today & Tomorrows printers & publishers, New Delhi
4. Handbook on Mushrooms, Nita Bahl, odord & IBH Publishing Co.
5. Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R (1991) Oyster Mushrooms, Department of Plant Patholory, Tamil Nadu Agricultural University, Coimbatore.
6. Swaminathan, M. (1990) Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co.Ltd., No. 88, Mysore Road, Bangalore -560018
7. Tewari, Pankaj Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi. 47 4. Nita Bahl (1984-1988)
8. Hand book of Mushrooms, II Edition, Vol. I &Vol. II. S.Biswas, S', M.Datta and S.V. Ngachan. 2011.
9. Mushrooms: A Manual for Cultivation. PHI learning private Ltd., New Delhi, India.
10. Chang, S. and P.G. Miles. 2004. Mushrooms: cultivation, nutritional value, medicinal effect, and environmental impact. CRC Press. USA.

GOVERNMENT COLLEGE OF (A), RAJAMAHENDRAVARAM**III B.Sc MICROBIOLOGY 6th – SEMESTER****MBY -118: 8B3 - INSTRUMENTATION AND BIOTECHNIQUES****TOTAL HOURS: 36****CREDITS: 3****UNIT-I****No. of Hours: 6**

- Bright field and dark field microscopy. Fluorescence Microscopy, Phase contrast Microscopy, Confocal Microscopy and Micrometry

UNIT – II**No. of Hours: 8**

- Principles and applications of paper chromatography (including Descending and 2D), Column packing and fraction collection. Gel filtration
- chromatography, ion-exchange chromatography' GLC and HPLC'

UNIT-III**No. of Hours: 8**

- Principle and applications of native polyacrylamide gel electrophoresis, SDS polyacrylamide gel electrophoresis, 2D gel electrophoresis and Iso electric focusing.

UNIT- IV**No. of Hours: 5**

- Principle and applications of study of absorption Spectra of bimolecular.
- Analysis of bimolecular using UV and visible range Turbidometry.

UNIT- V**No. of Hours: 8**

- Preparative and analytical centrifugation, fixed angle and swinging bucket rotors. RCF and sedimentation coefficient, differential centrifugation, density gradient centrifugation and ultracentrifugation'

8B3 - INSTRUMENTATION AND BIOTECHNIQUES PRACTICALS

TOTAL HOURS: 36

CREDITS: 2

1. Study of fluorescent micrographs to visualize bacterial cells.
2. Ray diagrams of phase contrast microscopy and Electron microscopy.
3. Separation of mixtures by paper / thin layer chromatograph.
4. Demonstration of column packing in any form of column chromatography.
5. Separation of protein mixtures by any form of chromatography.
6. Separation of protein mixtures by Polyacrylamide Gel Electrophoresis (PAGE).
7. Determination of lambda max for an unknown sample and calculation of extinction coefficient.
8. Separation of components of a given mixture using a laboratory scale centrifuge.
9. Understanding density gradient centrifugation with the help of pictures.

SUGGESTED READING

1. Nelson DL and Cox MM (2008). *Lehninger Principles of Biochemistry*, 5e Ed., W.H. Freeman and Company
1. Willey MJ, Sherwood LM & Woolverton C J (2013) *Prescott's Harley and Klein's Microbiology* 8th Ed McGraw Hill
2. Karp G. (2010) *Cell and Molecular Biology: Concepts and Experiments* 6th edition. John Wiley & Sons Inc
3. De Robertis EDP and De Robertis EMF. (2006). *cell and Molecular Biology* 8th edition. Lipincott Williams and Wilkins, Philadelphia.
4. Cooper G.M. and Hausman RE (2009) *The Cell: A Molecular Approach* 8th Edition. ASM Press Associates, MA. & Sunderland, Washington D'C, Sinauer