

**Proposed Syllabus  
For  
M.Sc. MICROBIOLOGY**



*Submitted by*  
**Department of Microbiology  
Kakatiya University  
Warangal – 506 009 (TS)**

**Under Choice Based Credit System  
With effective from 2021-2022  
KAKATIYA UNIVERSITY, WARANGAL-506 009**

### Minutes of the Meeting of Board of Studies in Microbiology

The meeting of board of studies in Microbiology was held on 20/12/2021 at 12.00 pm in the chamber of Head, Department of Microbiology to discuss the following agenda.

The following members were present

1. Dr. E. Sujatha : Chairman, BOS.
2. Dr. Srinivas Munjam : Head, Department of Microbiology.
3. Dr. P. Venkataiah : Member
4. Prof. Y. Narasimha Reddy : Member  
University college of Phar. Sciences,  
Kakatiya University.
5. Dr. T. Shastree : Member  
Dept. of Biotechnology,  
Kakatiya University.
6. Dr. Y. Venkaiah : Member  
Dept. of Bio-chemistry  
Kakatiya University.

After thorough discussion the following resolution was made

1. Resolved to approve of M.Sc Microbiology Semester wise syllabus (Theory and practical) with effect from the academy year 2021-2022 in all colleges under the jurisdiction of Kakatiya University.

Dr. E. Sujatha

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Dr. Srinivas Munjam

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Dr. P. Venkataiah

:

Prof. Y. Narasimha Reddy

:

Dr. T. Shastree

:

Dr. Y. Venkaiah

:



**KAKATIYA UNIVERSITY**  
**M.Sc. Microbiology Syllabus**  
**For the candidates admitted from the academic year 2021-2022**  
**For University College and affiliated colleges**

Paper Code	Title of Paper	Instruction Hours/week	No. of Credits	Marks		Total
				Internal Marks	External Marks	
ster I						
MBT 101	General Microbiology	4	4	20	80	100
MBT 102	Virology	4	4	20	80	100
MBT 103	Biological Chemistry	4	4	20	80	100
MBT 104	Cell biology & Enzymology	4	4	20	80	100
MBP 105	General microbiology & Virology	6	4	-	100	100
MBP106	Biological chemistry & Cell Biology & Enzymology	6	4	-	100	100
MBS 107	Seminar	1	1		-	25
	Total		25			625
ster II						
MBT 201	Microbial Physiology & Metabolism	4	4	20	80	100
MBT 202	Molecular Biology	4	4	20	80	100
MBT 203	Advanced Immunology	4	4	20	80	100
MBT 204	Biophysical Techniques & Instrumentation	4	4	20	80	100
MBP 205	Microbial Physiology & Molecular Biology	6	4	-	100	100
MBP 206	Adv. Immunol & Biophy. Tech. & Instrumentation	6	4	-	100	100
MBS 207	Seminar	1	1		-	25
	Total		25			625

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# FACULTY OF SCIENCE M.Sc. MICROBIOLOGY

## Semester – I

### Theory Paper –I

#### MBT-101: GENERAL MICROBIOLOGY

##### Unit – I

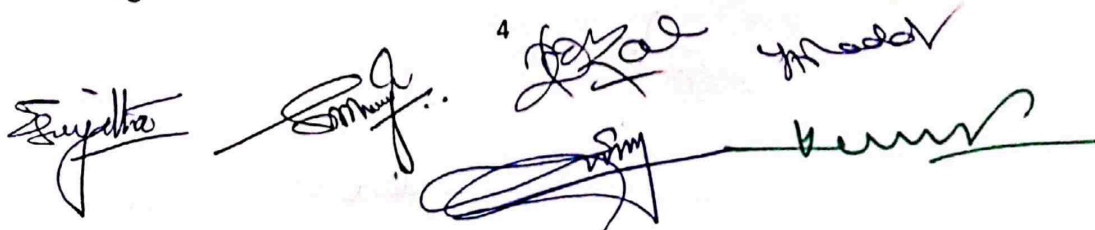
- Brief history of microbiology. Concepts of biodiversity, levels of biodiversity-importance and distribution of microbial diversity. Systematic position of microorganisms in universal tree of life.
- Exploration of microbial diversity: Culture dependant methods: Plate count method, community Level Physiological Profiles (CLLP), Culture independent methods: fatty acid methyl ester (FAME), phospholipid fatty acid (PLFA), Fluorescent antibody technique, FISH, whole cell *In situ* hybridization, reporter genes, thymidine incorporation.
- Nucleic acid based methods: G+C content, DNA reassociation, NA hybridization, Restriction fragment length polymorphisms (RFLP), Amplified fragment length polymorphisms (AFLP), Amplified ribosomal DNA (rDNA) restriction analysis (ARDRA), Rapid imaging spectrophotometric array (RISA)/Automated approach for ribosomal intergenic spacer analysis (ARISA), RAPD (Random amplified polymorphic DNA), Stable isotope proofing, Ribotyping, DNA microarrays.
- Metagenomic approach to explore microbial diversity; Concepts, principles, outlines of methodology.

##### Unit – II

- Ultra structure and functions of prokaryotic cell. Detailed study of Archae, Eubacteria and Eukarya.
- Major characters used in identification: morphological, physiological, biochemical, ecological, genetical and molecular identification, Numerical taxonomy.
- A brief account of Bergey's Manual (Determinative and Systematic), Classification of bacteria according to 2<sup>nd</sup> edition of systematic bacteriology.
- General characters and importance of Rickettsiae, Mycoplasma, Chlamydae and Archaeobacteria.

##### Unit – III

- Growth of bacteria: Batch and continuous cultures. Factors influencing the growth, growth curve.
- Microbial growth kinetics, Growth measurement of microscopic objects.





- c. Unculturable microbial diversity: Reasons for unculturability, improvements in culture cultivation methods. Distribution of unculturable microorganisms in different environments (marine, deep sea, hot springs, soil, biotic).
- d. Phylogeny and taxonomy of uncultured bacteria. Microbial dark matter.

#### Unit – IV

- a. Classification and general characters of algae- nutrition, thallus organization and reproduction. Characteristics of chlorophyceae, phaeophyceae, rhodophyceae and cyanophyceae.
- b. General characters and outline classification of fungi: Recent trends in classification of fungi according to Assembly of the Fungal Tree Of Life (AFTOL). Importance of filamentous fungi.
- c. Structure, reproduction, molecular and biotechnological aspects of Yeasts.
- d. General characters, distribution and classification of protozoa with special reference to pathogenic protozoa. General account of plasmodium, Entamoeba, nematodes and flatworms.

#### Recommended Books

1. Sneath, P.H.A. and R.R. Sokal 1973 Numerical taxonomy. The Principles and Practice of Numerical Classification, San Francisco. W.H. Freeman
2. Sneath, P.H.A 1989 Analysis and Interpretation of sequence data for bacterial Systematic. The view of a Numerical taxonomist .Syst.Appl.Microbiol.12:15-31
3. Tom Parker, M. Lerline, H.Collier, 1990, Principles of Bacteriology, Virology and Immunity, VIII Ed.
4. Garrity, M. George. Winters, B.S. Denise 2001 Taxonomic outline of the prokaryotic genera Bergeys Manual of Systematic Bacteriology. II Ed.
5. Balows, A.A.G. Thuper, M. Dworker, W. Harder, K.Schleifer 1991 The Prokaryotes , Springer,
6. Verlog Gunsales and Stainer, The Bacteria I-V vol. Academic press
7. M.Madigan, M. T., J.M.Mrtinko and J.Parker 2000 Brock Biology of Microbiology IX Ed .Prentice Hall Inter, Inc.
8. Garrity George, M. Edieor-In Cheaf 2005 Bergey's Manual of Systematic Bacteriology II Ed. (Vol- I-V). J. Brenner, K.R. Krieg, J.T.Stanly. Editors. Springer-Verlog
9. Balows, A.A.G. Thuper, M. Dworker, W. Harder, K. Schleifer 1991 The Prokaryotes , Springer,
10. Prescott, L.M., J.P Harley and D.AKlein, 2007 Microbiology VII Ed. Mc Grow Hill,
11. Davis R.Y. E.A. Adeberg and J.L. Ingram, 1991 General Microbiology
12. Stainer General Microbiology, V Ed., Printice Hall of India Pvt,Ltd. New Delhi
13. Schaechter.R. and Ledenberg.J 2004 The desk encyclopedia of microbiology. Elsevier Academic Press California.
14. Vandanme, D. B. Pot, M. Gillis, P. Devos, K. Kersters and J. Swings.1996 Polyphasic taxonomy, a consensus approach to Bacterial Systematic, Microbiological Reviews. 407-438.
15. Mehrotra RS and KR Aneja. An Introduction to Mycology, New Age Publishers.
16. Alexopoulos CJ et al, Introductory Mycology 4th Edition.
17. The Fungi: An Advanced treatise I-IV volumes (Ed) Ainsworth & Sussman; Academic Press.
18. Structure and Reproduction of algae FE Fritsch vol I & II.
19. Introductory Phycology – Trainor, F.R John Wiley, New York.
20. Protozoology – Grell, Karl G .1973 Springer – Verlag, Heidelberg.
21. The biology of Protozoa-Sleigh, MA American Elsevier, New York.

FACULTY OF SCIENCE M.Sc. MICROBIOLOGY  
Semester-I

Practical Syllabus Paper-I  
MBP- 105: GENERAL MICROBIOLOGY

Experiments

1. Preparation of culture media.
2. Micrometry-Calibration and measurement of microorganisms using ocular and stage micrometers and calculation of the mean and standard deviation.
3. Demonstration of bacterial motility by hanging drop technique
4. Gram staining
5. Endospore staining
6. Flagella staining
7. Capsule staining
8. Staining of PHB granules
9. Demonstration of mycorrhizal association.
10. Measurement of bacteria growth by turbidometric methods.
11. Cultivation of anaerobic bacteria:
  - i) Shake culture technique ii) Pyrogallic acid iii) Candle method iv) Liquid paraffin method v) Gaspak jar method
12. Identification of bacterial cultures by performing biochemical tests
  - a. Indole test
  - b. Methyl red test
  - c. VogesProskauer test
  - d. Citrate test
  - e. Oxidase test
  - f. Carbohydrate fermentation and Gas production
  - g. Catalase test
  - h. Gelatinase test
  - i. Caseinase test
  - j. Amylase test
  - k. H<sub>2</sub>S production test
  - l. Nitrate reduction test
  - m. Urease test

Spotters

- 1.Fungi: *Rhizopus*, *Mucor*, *Penicillium*, *Aspergillus*, *Alternaria*, *Curvularia*,
- 2.Algae: *Nostoc*, *Scytonema*, *Oscillatoria*, *Anabaena*, *Spirulina*,
- 3.Protozoa: *Trypanosoma*, *Giardia*, *Leishmania*, *Entamoeba histolytica*, *Plasmodium*,  
(permanent slides),
- 4.Helminthes: *Ascaris* (round worm), Tape worm (*Teneo solinum*).





**FACULTY OF SCIENCE M.Sc. MICROBIOLOGY**  
**Semester – I**  
**Theory Paper –II**  
**MBT 102: VIROLOGY**

**Unit – I**

- a. Brief account on discovery of viruses, Chemical composition, morphology and symmetry with reference to T4, TMV, Adeno, Influenza, Rhabdo and HIV. Genome diversity in viruses.
- b. Subviral particles: Satellite viruses, Viroids, DI particles and Prions
- c. Taxonomy of viruses: Classification and nomenclature of viruses as per latest version of ICTV.
- d. Isolation, purification, cultivation, assay and characterization of plant, animal and bacterial viruses.

**Unit – II**

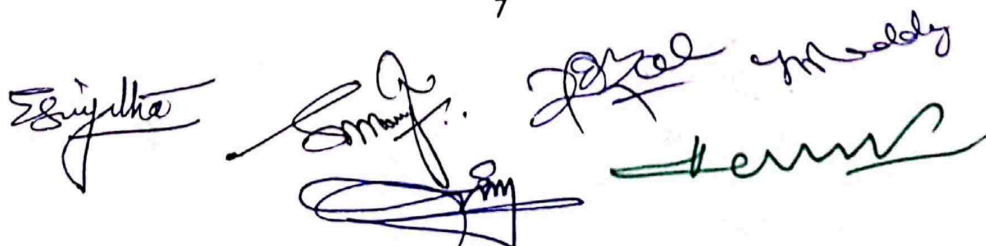
- a. Life cycles of bacterial viruses: One step growth curve, Lytic and Lysogenic cycles with reference to T4,  $\lambda$  Phage and  $\phi$ X174.
- b. Replication patterns of specific plant viruses TMV and CaMV.
- c. Replication strategies employed by animal viruses: Herpes, Hepatitis, Adeno, Retroviruses and Corona virus (SARS CoV).

**Unit – III**

- a. General account of oncogenic viruses (RNA and DNA).
- b. Viral interferons: nature and source of interferons, types of interferons, mode of action of interferons and therapeutic applications.
- c. Antiviral drugs: Mode of action of antivirus drugs, Inhibitors of viral attachment, entry of viral agents and uncoating, polymerase inhibitors, protease inhibitors, inhibitors of nucleoside and nucleotide reverse transcriptase and inhibitors of integrase.
- d. Viral vaccines: Conventional vaccines (live attenuated vaccines and killed vaccines), advanced vaccines (synthetic vaccines, recombinant subunit vaccines, vector vaccines, mRNA and DNA vaccines).

**Unit – IV**

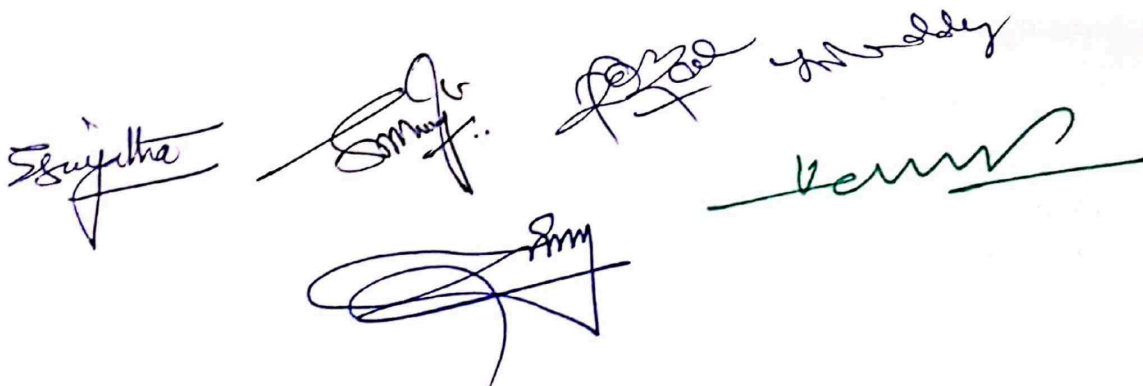
- a. Importance of applications of viruses in biotechnology, viruses as cloning vectors, CaMV promoter, Phage display.
- b. Viruses as therapeutic agents (Phage-based therapy). biocontrol agents (Agriculture and aquaculture), waste water treatment, environmental sanitizers.
- c. Importance and applications of bacteriophages, viruses for gene delivery.
- d. Emerging and reemerging viral diseases: Causes national and global impact strategies



for tackling emerging diseases, SARS COVID-19, Zika, Hanta, SARS, KFD, H1N1 (Influenza virus subtype), Chandipura viral encephalitis, Nipah viral encephalitis.

### Recommended Books

1. Alan J. Cann, 1997 Principles of Molecular Virology. (2<sup>nd</sup> edition). Academic Press, California.
2. Conrat HF, Kimball PC and Levy J.A. 1988 Virology. II edition. Prentice Hall, Englewood Cliff, New Jersey
3. Dimmock, N.J., Primrose, S. B. 1994 Introduction to Modern Virology IV edition. Blackwell Scientific Pub, Oxford
4. Flint, S.J., Enquist, L.W., Krung, R. Racaniello, VR. and Skalka, A.M. (2004). Principles of Virology, ASM Press
5. Molecular Biology, Pathogenesis and Control, ASM Press, Washington D.C.-
6. Roger Hull, 2002 Mathews' Plant Virology. (4<sup>th</sup> Edition). Academic press-A
7. Ram Reddy S and Reddy S M. 2007 Essentials of Virology Scientific Publishers (India) Jodhpur
8. Knipe, DM et al (eds) 2001 Fields Virology Vol I, Lippincott Williams and Wilkins
9. Granoff, A and Webster R.G. 1999 Encyclopedia of Virology Vol I, II and III San Diego Acad. Press
10. Medical Virology 10<sup>th</sup> Edition by Morag C and Timbury M C 1994. Churchill Livingstone, London.
11. Blackwell Scientific Publications. Oxford.
12. Virology 3<sup>rd</sup> Edition by Conrat H.F., Kimball P.C. and Levy J.A. 1994. Prentice Hall, Englewood Cliff, New Jersey.
13. Molecular Biology, Pathogenesis and Control by S.J. Flint and others. ASM Press, Washington, D.C. Applied Virology. 1984. Edited by Edonard Kurstak. Academic Press Inc.
14. Introduction to Modern Virology by Dimmock.
15. Prion diseases by Gaschup, M.H.
16. Clinical virology Manual by Stevens, S., Adinka, R.L., Young, S.A.



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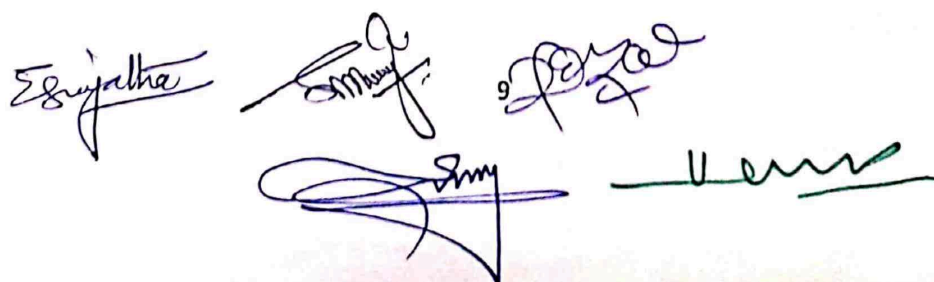
**FACULTY OF SCIENCE M.Sc. MICROBIOLOGY**  
**Semester-I**  
**Practical Syllabus Paper-II**  
**MBP 105: VIROLOGY**

**Experiments**

- 1) Isolation of phages from soil/sewage.
- 2) Cultivation and preservation of phages.
- 3) One step growth curve for determination of virus titer.
- 4) Cultivation of animal viruses in developing chick embryo (Amniotic, allantoic, CAM).
- 5) Lysogeny-transduction.
- 6) Demonstration of cytopathological changes (slides/pictures).
- 7) Symptomatic observations of plant viral infections.
- 8) Estimation of chlorophyll content in healthy and viral infected leaves.
- 9) Estimation of protein content in healthy and viral infected leaves.
- 10) Haemagglutination inhibition.

**Spotters**

1. Beijerinck.
2. W.M Stanely.
3. Tobacco mosaic virus (TMV).
4. Adenovirus.
5. T4 phage.
6. HIV.
7. SARS CoV.
8. Symptoms of plant viral diseases.
9. Symptoms of animal viral diseases.
10. Prions.
11. Density-gradient centrifugation.
12. Genome of Øx174.
13. Plates showing plaques.
14. Latex droplet method.
15. ELISA.
16. *E.coli* infected with T4 phage.



**FACULTY OF SCIENCE M.Sc. MICROBIOLOGY**

**Semester – I**

**Theory Paper –III**

**MBT 103: BIOLOGICAL CHEMISTRY**

**Unit - I**

- Carbohydrates: Structure, characters and classification. Physico-chemical properties. Monosaccharide-functional isomers, ring structure, glycosides, derivatives of monosaccharide - amino sugars, sugar acids and phosphorylated sugars.
- Oligosaccharide-Disaccharides- sucrose, lactose and maltose. Trisaccharides-Raffinose, tetrasaccharide, stachyrose.
- Polysaccharides-Structure and occurrence (starch, cellulose, chitin, glycogen and peptidoglycan). Homoglycons, heteroglycons and conjugated glycons. Biological significance of polysaccharides.
- Functions of carbohydrates-Energy storage, structural elements, and metabolic intermediates. Carbohydrates as informational molecules.

**Unit - II**

- Amino acids – Structure, chemical properties and types of amino acids, standard amino acids, nonstandpard amino acids, peptide bond. D-amino acids, beta- and gamma-amino acids.
- Classification of amino acids. Essential and non-essential amino acids. Analysis of mixtures of amino acids. Derivatives of amino acids.
- Proteins classification, Physico-chemical properties and biological functions of proteins. Structure organization-Primary, secondary, tertiary and quaternary structures and specificity of proteins, supramolecular assemblies of proteins, glycoprotein and proteoglycans..
- Structure and purification methods-Protein isolation, solubilities of proteins, chromatographic separation of proteins and electrophoresis. Characterization of proteins.

**Unit - III**

- Lipids - physico - chemical properties, separation, distribution in nature, characterization and saponification and iodine number.
- Classification of lipids, nomenclature, outline structure, properties and functions of glycerides, neutral lipids (waxes, fats and oils).
- Phospholipids, spingophospholipids and glycolipids. Steroids- steroid hormones, hormone precursors, plant sterols, ergosterol, stigmsterol and cholesterol.
- Properties of lipid aggregates-Micelles and bilayers, liposomes, bilayer dynamics. Biological membranes, fluid mosaic model of membrane structure. Important features of bacterial lipids.

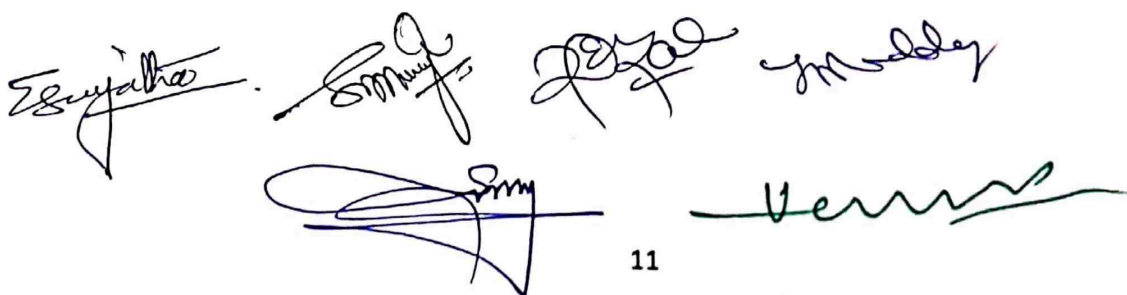


#### Unit – IV

- a. Types and composition of purine and pyrimidine bases and their nomenclature, nucleosides, nucleotides and polynucleotides. Nucleic acids: Types of RNA and DNA, their structure, properties and functions.
- b. Vitamins: Classification, definition and general characteristics, classification of water soluble vitamins, structure and their biochemical properties.
- c. Vitamins: Classification of fat soluble vitamins, structure and their biochemical properties. Deficiency and human requirement of different vitamins.
- d. Porphyrins: Porphyrin nucleus and classification. Importance of metalloporphyrins occurring in nature-haemoglobin, chlorophyll. Bile pigments-chemical nature and their physiological significance.

#### Recommended Books

1. Voet Donald and Voet J.G .3<sup>rd</sup> Edition , Biochemistry John Wiley and sons INC
2. Zubay .G. Biochemistry- Wm.C.brown Publishers
3. White .D. 2000 The Physiology and Biochemistry of prokaryotes-Oxford Univ.press
4. Lehninger A.L.Cox and Nelson -2006,4<sup>th</sup> Edition, Principles of Biochemistry –CBS Publishers and Distribution Pvt.Ltd
5. Stryer .L.5<sup>th</sup> Edition –Biochemistry .W.H. Freeman and Co
6. Wilson. K. and Walker.J.2000 Principle and Techniques –Practical Biochemistry-Cambridge University press
7. Murray, Harpers Biochemistry Mc Graw Hill
8. White , Handler and Smith-Biochemistry
9. West and Todd –Biochemistry Mac Millan Publishers
10. Corn and Stumpf, 5<sup>th</sup> Edition-Outlines of Biochemistry-Wiley Eastern Publications.
11. Morrison –Physical Biochemistry (Oxford )
12. Satyanarayana and Chakrapani 3<sup>rd</sup> Edition-Biochemistry Books and Allied Publishers
13. Trevor Palmer 2004 Enzymes, Affiliated East-West Press Pvt .Ltd
14. Dixon and Webb –Enzymes
15. Rawn, J.D.2004 Biochemistry Panima Pub. Corporation.
16. Voet Donald, J.W.Voet and Ch.W. Pratt, 2006 Fundamentals of Biochemistry 2<sup>nd</sup>ED.Jhon Willey & Sons Inc.
17. David,E. Metzler,2006 Biochemistry 2<sup>nd</sup> Ed Academic Press
18. William, H. Elliott and Daphne ,C. Elliot, 2004 Biochemisry and Molecular Biology 2<sup>nd</sup> ED Oxford University Press





**FACULTY OF SCIENCE M.Sc. MICROBIOLOGY**  
**Semester - I**

**Practical Syllabus Paper - II**  
**MBP 106: BIOLOGICAL CHEMISTRY**

**Experiments**

1. Quantitative estimation of glucose by Anthrone method
2. Quantitative estimation of reducing sugars by 3, 5, DNS method
3. Quantitative estimation of fructose
4. Quantitative estimation of proteins by Lowry's method
5. Quantitative estimation of Indole Acetic Acid
6. Quantitative estimation of Ascorbic acid
7. Quantitative estimation of Amino acid
8. Qualitative test of carbohydrates: Glucose, Xylose, Starch, Lactose, Maltose, Sucrose
9. Qualitative test of amino acids: Tryptophan, Tyrosine, Methionine, Arginine, Proline,
10. Qualitative test of proteins: Gelatin, Globulin, Albumin, Peptone, Casein
11. Determination of iodine number of fat
12. Qualitative test of lipids: Cholesterol

**Spotters**

1. Structure of monosaccharides
2. Structure of Oligosaccharides
3. Structure of Polysaccharides
4. Structure of Amino acids
5. Structure of Proteins
6. Structure of Phospholipids
7. Structure of Cholesterol
8. Structure of nucleotides
9. Structure of DNA
10. Structure of t-RNA
11. Structure of Cyanocobalamine (Vit B12)
12. Structure of Porphyrin





**FACULTY OF SCIENCE M.Sc. MICROBIOLOGY**  
**Semester - I**  
**Theory Paper- IV**  
**MBT 104: CELL BIOLOGY AND ENZYMOLOGY**

**Unit - I**

- a. Principles of bioenergetics – Laws of thermodynamics, enthalpy, entropy, concept of free energy: chemical equilibria; structure and energetics of ATP molecule and other high energy compounds, types of phosphorylation. Oxidation and reduction reactions.
- b. Chemiosmotic hypothesis and proton motive force and energy transformations. Electron transport, oxidative phosphorylation, structure of ATP synthase; mechanism of ATP synthesis. Inhibitors and uncouplers
- c. Membrane structure and dynamics; diversity structure and physiology of membrane pumps, carriers and channels.
- d. Cell signaling pathways: Basic elements of signaling system; extracellular signal molecules, receptors-ion linked, G-protein linked and enzyme linked receptors; calcium and NO as intracellular messengers. Convergence, divergence and crosstalk among different signaling pathways.

**Unit - II**

- a. Cell cycle: Over view, phases of the cell cycle, cell growth and extra cellular signals, Regulations of cell cycle progression (cyclins and cyclin dependent kinases), cell differentiation and cell cycle check points.
- b. Cancer biology: Types of cancers-benign and malignant, carcinogens - physical, chemical and biological, carcinogenesis, metastasis and invasion, tumorigenesis.
- c. Cancer critical genes: Proto-oncogenes, oncogenes, tumor-suppressor genes (antioncogenes), p53 gene, telomeres and cancers.
- d. Apoptosis (Programmed cell death): Apoptosis pathways and molecular mechanism of apoptosis.

**Unit - III**

- a. Introduction and historical perspective of enzymes; properties, classification and nomenclature; structures and biological functions; theory of enzymatic catalysis.
- b. Specificity of enzymes; Models of enzymes action-Fisher's lock and key hypothesis, Koshland's induced fit hypothesis, Haldane and Pauling concept.
- c. Enzyme kinetics: Effect of substrate concentration, derivation of Michaelis-Menten equation,  $K_s$ ,  $K_m$ ,  $V_{max}$  and  $K_{cat}$  and their significance, methods to determine  $K_m$  and  $V_{max}$ ; Lineweaver-Burk plots, Eadie-Hofstee and Hanes plots.
- d. Enzyme inhibition – competitive, un-competitive, non-competitive, partial, substrate, allosteric inhibitions. Allosteric enzymes, Isozymes, Abzymes.

## Unit - IV

- a. Enzyme regulation: Product inhibition and feedback control, allosteric regulation, regulation, enzyme induction and repression, chemical modifications, covalent modifications, calmodulin mediated regulation.
- b. Immobilization of enzymes: Methods of immobilization, ionic binding, adsorption, covalent bonding, micro-encapsulation and gel entrapment, membrane confinement; Practical and economic advantages of enzymes for industrial use.
- c. Enzyme purification: Techniques of enzyme purification, assessment of purity, units of enzyme activity, recovery and yield of enzymes, characterization of enzymes.
- d. Enzyme stabilization by selection and genetic engineering, molecular graphics in protein engineering – Biosensors (glucose oxidase, cholesterol oxidase, urease and antibodies as biosensors).

### Recommended Books

1. Getzen berg, R.H. and E.E. Bittar, Cell Structure and Signaling, Elsevier Science.
2. Cossart et al. 2000 Cellular Microbiology
3. Phillip Sheeler and Donald E. Blanch Cell & Molecular Biology 3<sup>rd</sup> ED John Willey Pub.
4. Ernet, J.M. Helmreich, The Biochemistry of Cell Signaling, Oxford Press.
5. Cooper, The Cell.
6. De Roberts and De Roberts, 1998 Cell and Molecular Biology. Wavely Pvt. Ltd.
7. Voet and Voet J.G. 3<sup>rd</sup> Edition, Biochemistry John Wiley and sons INC
8. Zubay .G. Biochemistry- Wm.C. Brown Publishers.
9. White .D. 2000 The Physiology and Biochemistry of prokaryotes-Oxford Univ. Press.
10. Lehninger A.L. Cox and Nelson -2006, 4th Edition, Principles of Biochemistry –CBS Pub.
11. Gottschalk .G. 1985 Bacterial metabolism –Springer Verlag
12. Stryer .L. 5<sup>th</sup> Edition –Biochemistry. W. H. Freeman and Co
13. Wilson. K. and Walker.J. 2000 Principle and Techniques –Practical Biochemistry-Cambridge University Press.
14. Murray, Harpers Biochemistry Mc Graw Hill.
15. Morrison –Physical Biochemistry (Oxford).
16. Satyanarayana and Chakrapani 3<sup>rd</sup> Edition-Biochemistry Books and Allied Publishers.
17. Trevor Palmer – Enzymes, 2004 Affiliated East-West Press Pvt .Ltd.
18. Dixon and Webb –Enzymes.
19. Pollard T D and Earnshaw W. C. 2008 Cell Physiology 2<sup>nd</sup> ed Saunders, Elsevier.
20. Albert *et al.*, Molecular Biology of cell. 4<sup>th</sup> Edition Garland Publishing Inc.
21. Karp Gerald 2008 Cell and Molecular Biology John Wiley & Sons, Inc. Lewin, B. 2004 Genes VIII. Oxford University Press, Oxford.
22. Principles of Biochemistry, 3<sup>rd</sup> Edition by Lehninger, Nelson & Cox.
23. White, D. 1995 The Physiology and Biochemistry of Prokaryotes, Oxford University Press,

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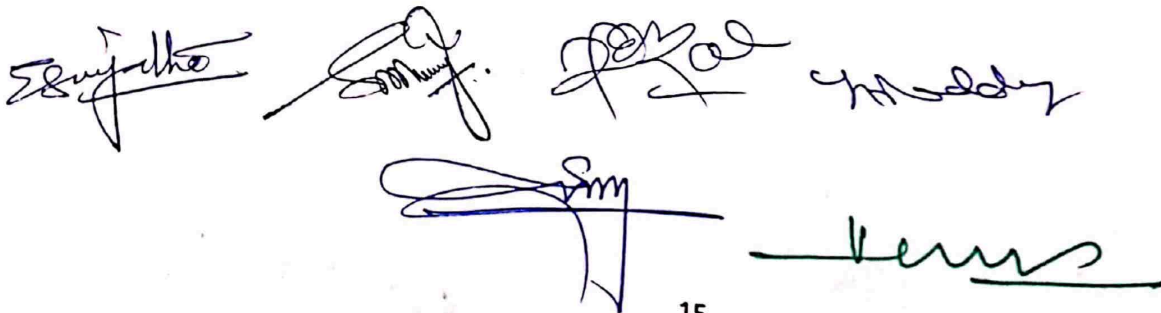
**FACULTY OF SCIENCE M.Sc. MICROBIOLOGY**  
**Semester – I**  
**Practical Syllabus Paper- IV**  
**MBP 106: CELL BIOLOGY AND ENZYMOLOGY**

**Experiments**

1. Demonstration of mitotic cell division stages
2. Demonstration of meiotic cell division stages
3. Evaluation of kinetic constant of the purified enzyme.
4. Effect of PH on enzyme activity
5. Effect of temperature on enzyme activity
6. Effect of time on enzyme activity
7. Effect of enzyme concentration on enzyme activity
8. Effect of enzyme inhibitors on enzyme activity.
9. Immobilization of Enzymes
10. Enzyme purification
11. Estimation of arginase activity
12. Estimation of catalase activity.

**Spotters**

1. Giant chromosomes
2. Polytene chromosome
3. Lampbrush chromosome
4. Cell cycle
5. Metaphase
6. Anaphase
7. Lock and key model
8. Allosteric inhibitors
9. Un- Competitive enzyme activity
10. Non-Competitive enzyme activity
11. Competitive enzyme activity
12. Lineweaver-Burk plots.



**FACULTY OF SCIENCE M.Sc. MICROBIOLOGY**  
**Semester – II**  
**Theory Paper – I**  
**MBT 201: MICROBIAL PHYSIOLOGY AND METABOLISM**

**Unit – I**

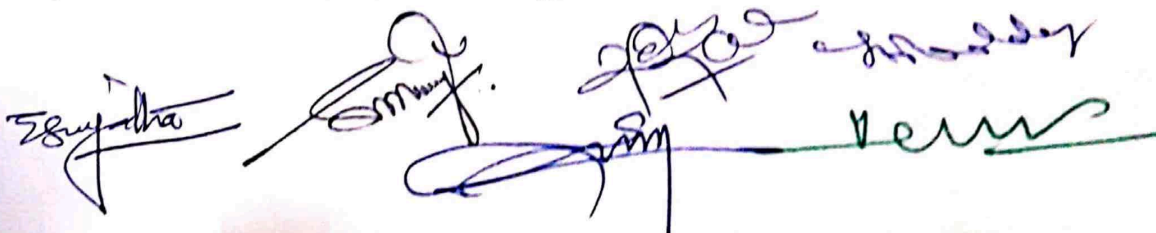
- a. Nutritional diversity in microorganisms, nutritional types - autotrophy, heterotrophy, chemotrophy, phototrophy, lithotrophy and organotrophy. Nutrition - essentiality of major and minor elements, growth factors.
- b. Uptake of nutrients: passive diffusion, facilitated diffusion, active transport, group translocation, iron transport-siderophores.
- c. Chemotrophism: (sulphur, ammonia, nitrite, iron, hydrogen, carbon monoxide oxidizers) and their importance, reverse electron transport, CO<sub>2</sub> assimilation, reductive acetyl COA pathway.
- d. Chemoheterotrophism: Acetogens, Methanogens, physiology of methanogenesis and its importance. Physiology and economic importance of methylotrophs.

**Unit – II**

- a. Phototropism: Oxygenic and anoxygenic phototrophs and their diversity, photosynthetic pigments and their light absorption, basic photochemistry of PSI, PSII and light driven electron transport.
- b. Modes of CO<sub>2</sub> fixation (Calvin cycle, reverse TCA cycle, HP pathway), Halobacterial photosynthesis. Anaplerotic reactions.
- c. Carbohydrate metabolism - various pathways underlying the utilization of different sugars (EMP, ED, HMP, phosphoketolase pathway) in microorganisms. Gluconeogenesis and its significance.
- d. Outlines of inter relationship between carbohydrate, protein and lipid metabolisms.

**Unit – III**

- a. Aerobic respiration: TCA cycle- intracellular location and reactions, amphibolic reactions. Glyoxalate cycle. Mechanisms of substrate-level phosphorylation. Respiratory electron transport in mitochondria and bacteria. Mechanism of oxidative phosphorylation.
- b. Anaerobic respirations: sulphate, nitrate, carbonate respirations and their ecological significance.
- c. Fermentations: Types of fermentations, alcoholic, lactate, propionate, mixed acid, butyrate and butanol fermentations and their industrial importance.
- d. Concepts of primary and secondary metabolisms. Biosynthesis of secondary metabolites with special reference to penicillin and polyketides, biotransformation, Bioluminescence, quorum sensing.





## Unit – IV

- a. Lipid metabolism: Biosynthesis of glycerols, phospholipids, glycolipids and fatty acids. Cholesterol biosynthesis. Oxidation of saturated and unsaturated fatty acids.
- b. Amino acid metabolism: Assimilation of inorganic nitrogen and sulphur. Biosynthetic pathways of amino acids and their regulation with emphasis on tryptophane and histidine. Porphyrine biosynthesis.
- c. Catabolism of aminoacids: Transaminaton, decarboxylation and deamination. Degradation of proteins-proteases, exo-endo peptidases.
- d. Nucleotide metabolism: Biosynthesis of purine and pyrimidine nucleotides-salvage and *de novo* pathways. Biosynthesis of deoxyribonucleotides and regulation. Catabolism of nucleotides.

## Recommended Books

1. Caldwell, D.R. 1995 Microbial Physiology and Metabolism, Wm. C. Brown Publishers, USA
2. Lansing M. Prescott, John P. Harley and Donald A. Klein. 2019 Microbiology (9th edition). McGraw-Hill Company, New York.
3. Larry McKane and Judy Kandel. 1996 Microbiology-Essentials and applications. (2nd edition). Mc Graw Hill, Inc., New York.
4. Moat, A.G. and Foster, J.W. 1988 Microbial Physiology (Second Edition). John Wiley & Sons.
5. Pelczar Jr, M.J. Chan, E.C.S., Kreig, N.R. 1993 Microbiology, Mc. Graw Hill. Inc, New York.
6. Salle, A.J. 1996 Fundamental principles of Bacteriology (7th edition). Tata McGraw-Hill publishing company limited, New Delhi.
7. White, D. 1995 The Physiology and Biochemistry of Prokaryotes, Oxford University Press,
8. Ram Reddy, S and S.M. Reddy, 2006 Microbial Physiology, Scientific Pub, Jodhpur.
9. Donald Voet and Judith G. Voet, 1995. Biochemistry – Second Edition. John Willey and Sons,
10. Lubert Stryer. 1995. Biochemistry.(4th edition). W.H. Freeman and company, New York.
11. Zubay, G. 1998 Biochemistry WCB. Mc Graw – Hill, Iowa.
12. Principles of Biochemistry, 3rd Edition by Lehninger, Nelson & Cox.
13. Harper's Review of Biochemistry by Martin, Mayer & Rodwell.
14. Smith, Hill, Lehman, Lefkowitz, Handler & White. Principles of Biochemistry: General aspects
15. Outlines of Biochemistry (5th edition) Conn, Stumpf, Bruening & Doi.
16. Gottschalk G. 1986 Bacterial Metabolism 2nd ed. New York: Springer –Verlag.
17. Dawes, I.W., Sutherland ,IW 1992 Microbial Physiology 2<sup>nd</sup> edition London: Blackwell scientific Publishers

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**FACULTY OF SCIENCE M.Sc. MICROBIOLOGY**

**Semester – II**

**Practical Syllabus Paper – I**

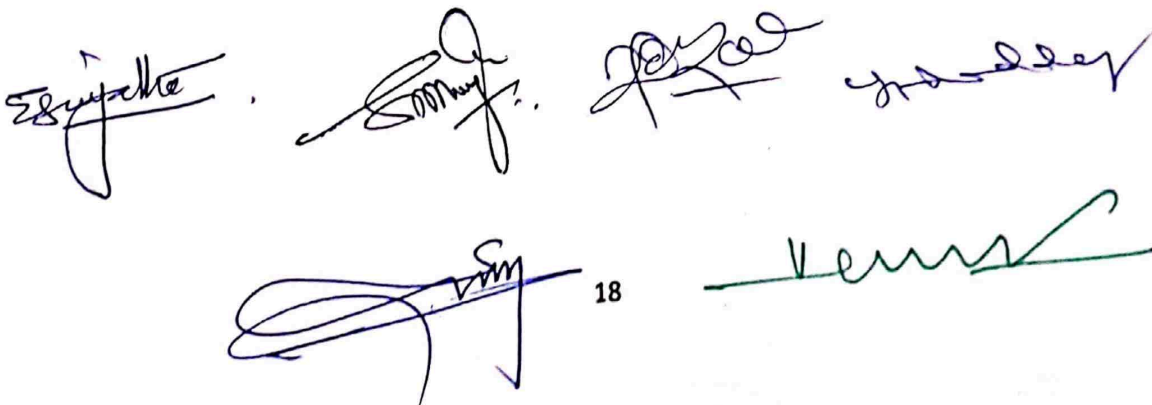
**MBP 205: MICROBIAL PHYSIOLOGY & METABOLISM**

**Experiments**

1. Growth of the bacteria at different  $p^H$ .
2. Effect of different temperatures on bacterial growth.
3. Effect of osmotic pressure.
4. Isolation of photosynthetic bacteria from sewage water.
5. Estimation & characterization of bacterial chlorophylls.
6. Enrichment cultivation of photosynthetic bacteria – Winogradsky column.
7. Determination of Thermal death time.
8. Carbohydrate catabolism by microorganisms through oxidation and fermentation of glucose.
9. Estimation of ethanol in fermentation broth.
10. Estimation of lactic acid in fermentation broth.

**Spotters**

1. Passive diffusion.
2. Facilitated diffusion.
3. PSI.
4. PSII.
5. Halobacterial photosynthesis.
6. Electron transport.
7. Biotransformation.
8. Bioluminescence.
9. Quorum sensing.
10. Phospholipids.
11. Steroids.
12. Ribonucleotide reductase.



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**FACULTY OF SCIENCE M.Sc. MICROBIOLOGY**  
**Semester – II**  
**Theory Paper – II**  
**MBT 202: MOLECULAR BIOLOGY**

**Unit – I**

- a. Chromosome organization in prokaryotes and eukaryotes.
- b. DNA replication: General principles, enzymes involved in DNA replication, various models of replication (semi conservative, rolling circle, unidirectional and bidirectional). DNA synthesis by reverse transcription, inhibitors of DNA replication.
- c. DNA damage: Types of damage (deamination, oxidative damage, alkylation, and pyrimidine dimers).
- d. DNA Repair pathways: Methyl-directed mismatch repair, very short patch repair, nucleotide excision repair, base excision repair, recombination repair and SOS system.

**Unit – II**

- a. Structural features of rRNA, tRNA and mRNA and their functions.
- b. Transcription: General principles, basic apparatus, RNA polymerases, promoters, enhancers and other regulatory sequences.
- c. Mechanism of transcription and inhibitors of transcription in prokaryotes and eukaryotes.
- d. Post-transcriptional modifications: Transcriptional attenuation, cutting and trimming of rRNA, mRNA modifications (capping, polyadenylation and splicing), cutting and modification of tRNA, catalytic RNA (Ribozymes), group I and group II intron splicing and RNase P.

**Unit – III**

- a. Translation: Basic features of genetic code, Wobble concept, prokaryotic and eukaryotic ribosomes.
- b. Details of translation: Initiation, elongation and termination, factors that control the translation, inhibitors of protein synthesis.
- c. Post-translational modifications: Chemical modifications of proteins, proteolytic degradation, Inter splicing and protein folding.
- d. Protein sorting and targeting: Signal hypothesis-signal sequences, signal recognition particle and role of molecular chaperones in protein folding and targeting.

**Unit – IV**

- a. Regulation of gene expression: Operon concept, regulatory elements of operon - inducers, apo-repressors and co-repressors, positive and negative regulations, catabolite repression and regulation attenuation.



- b. Detailed account of structure, function and regulation of *lac* operon, *trp* operon and *ara* operon.
- c. Global regulatory responses: Heat shock response, stringent response, SOS response and Regulation by small molecules such as ppGPP, pppGPP and cAMP.
- d. Hormone and Environmental factors affecting gene expression coordinate regulation of unlinked genes. Regulatory RNA.

### Recommended Books

1. Brown, T.A. 1999 Gene Cloning. 3rd edition. Chapman and Hall Publications, USA.
2. Chirikjian, J.G. 1995 Biotechnology – Theory and Techniques, Vol. II, Jones and Bartlett Publishers.
3. Gerhardt, P. Murray, R.G., Wood, W.A., and Krieg, N.R. 1994 Methods for General and Molecular Bacteriology, ASM Press, Washington D.C.
4. Glick, B.R. and Pasternak, J.J. 1998 Molecular Biotechnology – Principles and Applications of Recombinant DNA, ASM Press, Washington D.C.
5. Lewin, B. 2008 Genes IX. Oxford University Press, Oxford.
6. Murray Moo 1992 Plant Biotechnology. Young, Pergamon Press.
7. Antony, J.F., Griffiths, Gilbert, W.M., Lewontin, R.C. and Miller, J.H. 2002 Modern genetic analysis, Integrating Genes and Genomes, 2nd edition, WH Freeman and Company, New York.
8. Blackburn, G.M. and Gait, M.J. 1996 Nucleic acids in chemistry and biology. Oxford University Press.
9. Molecular Biology of cell. Albert *et al.*, 4th Edition Garland Publishing Inc.
10. Maloy, S.R., Cronan, J.R. Freifelder, D. 1994 Microbial Genetics, Jones and Bartlett Publishers.
11. Macinski, G.M. and Freifelder, D. 1998 Essentials of Molecular Biology, 3rd Ed, John and Bartlett Publishers.
12. Sir John Kendrew 1994 The Encyclopedia of Molecular Biology. Blackwell Science Ltd
13. Watson, J.D., Hopkins, N.H., Roberts, J.W., Steitz, J.A. and Weiner, A.M. 1998 Molecular Biology of the Gene, 4th edition, Benjamin/Cummings publishing company.
14. Freifelder, D. 1997 Essentials of Molecular Biology. Narosa Publishing House, New Delhi.
15. Freifelder, D. 1990 Microbial Genetics. Narosa Publishing House, New Delhi.
16. Snyder, L. and Champness, W. 1997 Molecular Genetics of Bacteria. ASM press, USA.
17. Maloy, S.R., Cronan, J.E. and Freifelder, D. 1994 Microbial Genetics, Jones and Bartlett Publishers, London.
18. Turner, P.C., McLennan, A.G., Bates, A.D. and White, M.R.H. 1998 Instant Notes in Molecular Biology, Viva Books Pvt., Ltd., New Delhi.
19. Twynan, R.M. 2003 Advanced Molecular Biology. Viva books Pvt. Ltd. New Delhi.
20. Ram Reddy S, Venkateshwarlu K and Krishna Reddy V 2007 A Text Book of Molecular Biotechnology Himalaya Publishers Hyderabad.
21. Ram Reddy S. 2021. Plant Molecular Biology, Telugu Akademi (English version) Hyderabad.

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**FACULTY OF SCIENCE M.Sc. MICROBIOLOGY**  
**Semester – II**

**Practical Syllabus Paper – II**  
**MBP 205: MOLECULAR BIOLOGY**

**Experiments**

1. Estimation of DNA by DPA method.
2. Estimation of RNA by orcinol method
3. Isolation of DNA from sheep Liver / yeast/ *E.coli*
4. Determination of purity of DNA
5. Isolation of RNA from plant sample
6. Isolation of RNA from viral infected plant sample
7. Problems on DNA characteristics
8. Problems related to Transcription, Genetic code,
9. Problems related to Translation and Gene regulation.

**Spotters**

1. ATPase
2. Semiconservative model of DNA replication
3. Rolling circle replication
4. Replication fork
5. Nucleosomes
6. DNA damages
7. Action of topoisomerases
8. Okazaki fragments
9. RNA splicing & spliceosome
10. Structure of *lac* operon
11. Structure of *Trp* operon
12. Structure of *Ara* operon
13. Structure of CAMP.
14. Structure of PPPPGTP.
15. Molecular Chaperons
16. Ribosomes.

*Singh* *Am* *Fazal* *Mahdy*  
*Am* <sup>21</sup> *Am*

FACULTY OF SCIENCE M.Sc. MICROBIOLOGY

Semester-II

Theory Paper – III

MBT 203: ADVANCED IMMUNOLOGY

Unit – I

- History and scope of immunology, haematopoiesis, structure and function of cells and organs of immune system.
- Types of immunity (innate and acquired, active and passive) immune response (cell mediated and humoral response).
- Immunohaematology: Blood groups, blood transfusion, Rh-incompatibility.
- Antigens: Antigen types, haptens, epitopes, adjuvants, Antigen specificity. Antibodies: Immunoglobulins structure, distribution and function. Theories of antibody production.

Unit – II

- Immunological reactions: *In vitro* methods: Agglutination, Precipitation, Complement fixation, Immunofluorescence, ELISA and RIA, cell-sorting-flow cytometry.
- In vivo* methods: Phagocytosis, Opsonization and Neutralization.
- Complement components, complement activation pathways (Classical, Alternative and Lectin pathways).
- Regulation of complement system, biological consequences of complement, and complement deficiencies.

Unit – III

- Transplantation immunology: Structure and functions of MHC (Major histocompatibility complex).
- HLA tissue typing and Organ transplantation (graft versus host reaction and rejection).
- Tumor Immunology: Tumor antigens, Host immune response to tumors.
- Tumors escape mechanisms, immunodiagnosis of tumors and immuno-therapy of tumors.

Unit – IV

- General account of immuno deficiency disorders: Primary and Secondary Immunodeficiency. Phagocytic cell disorder, Autoimmunity and autoimmune disorders.
- Hypersensitivity reactions: Type-I, II, III and IV and their respective diseases, immunodiagnostic methods of hypersensitivity.
- Hybridoma technology for synthesis of monoclonal antibodies and their applications. Recombinant antibodies.
- Types of Vaccines: whole organism vaccines, Recombinant vaccines, DNA vaccines, synthetic peptide vaccines, Subunit vaccines, Immunization procedures.

## Recommended Books

1. Bellanti, J.A. 1985 Immunology III Ed.
2. Coleman, R.M. Lambard, M. F. and Siccard, 1992 Fundamental of Immunology II Ed.
3. Kuby, J. 2004 Immunology VI Ed. W.H. Freeman and Company New York.
4. Poul, W.E. 1990 Fundamental of Immunology II Ed. Ravar Press, New York.
5. Riot, M.Ivan 1998 Essential Immunology VII Ed. ELBS and Black well Scientific Pub.,
6. Tizzard, I.R. 2004 Immunology an Introduction II Ed. Thomson Asia Pvt. Ltd
7. Ross, G.D. Immunology of the complement System
8. Riott, J.M. Brostoff, J.J and Male D.K. 1996 Immunology IV Ed. CV Mos by Pub. St. Louis.
9. Johnstone, A. and R. Thrope Immunology Chemistry.
10. Johnstone, A. and R. Thrope Immunology Voll, II
11. Weir, Hand Book of experimental Immunology
12. Stiter, Terr and Parlow Basic and Clinical Immunology
13. Tom Parker, M. Lesline, H. Collier, 1990 Principles of Bacteriology, Virology and Immunity. VII Ed.
14. Chapel, H. and Halbey, 1986 Essentials of clinical Immunology ELBS London.
15. Donald M. Weir, John Steward, 1993 Immunology VII Ed. ELBS, London.
16. Hue Davis, 1997 Introductory Immunology Champman and Hall Publisher.
17. Peter, J Delves, Ivan M. Roit Ed 1998 Encyclopedia of Immunology II Ed. Acad, Press.
18. Ridklad, M. Aydl, 1995 Immunology II Ed. Baltimore, Hangkang, NMS Pub.
19. Janeway, C. 2004 Immunology VI ED, Garland Science. New York.

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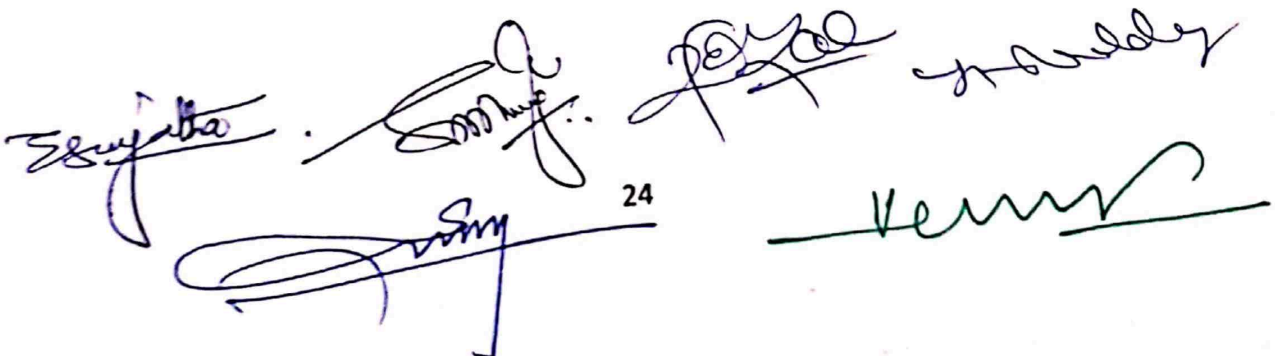
**FACULTY OF SCIENCE M.Sc. MICROBIOLOGY**  
**Semester – II**  
**Practical Syllabus Paper- III**  
**MBP 206: ADVANCED IMMUNOLOGY**

**Experiments**

1. Typing of human blood groups. (Haemagglutination).
2. Differential staining of WBC by Leishman's stain.
3. Enumeration of RBC and WBC.
4. Estimation of hemoglobin count in blood.
5. Widal tests: i) Slide agglutination ii) Tube agglutination methods.
6. VDRL test (Venereal disease research laboratory).
7. Hepatitis-B Surface antigen test.
8. HCG test (Agglutination inhibition test).
9. ELISA test.
10. Detection of rheumatoid factor (RF factor).
11. ASO Test- Anti streptolysin 'O' test.
12. Immuno diffusion test: i) Single radial immuno diffusion ii) Double immuno diffusion.
13. Immunoblotting for detection of proteins by staining.
14. Immuno electrophoresis.
15. Isolation of lymphocytes.

**Spotters**

1. Lymph node.
2. Spleen.
3. Thymus gland.
4. Structure of IgG, IgM, IgA, IgE.
5. Monoclonal antibodies.
6. ELISA plate.
7. Immuno precipitation.
8. Flow cytometry.
9. Immunofluorescence.
10. RIA.
11. Hypersensitive reactions Type-I,II,III,IV
12. Systemic lupus erythematosus (SLE).
13. Myasthenia gravis disease.



**FACULTY OF SCIENCE M.Sc. MICROBIOLOGY**  
**SEMESTER- II**  
**Theory Paper- IV**  
**MBT 204: BIOPHYSICAL TECHNIQUES & INSTRUMENTATION**

**Unit – I**

- a. Buffers: Henderson and Hesselbach equation,  $P_{ka}$  and  $P_{kb}$ . Preparation of buffers, measurement of pH, types of electrodes.
- b. Viscosity: specific, intrinsic and reduced viscosities, viscometers, determination of molecular size and shape through viscosity.
- c. Osmosis: Osmosis in relation to molecular size and molecular weight, osmometer; Dialysis, Membrane filtration and application.
- d. Microscopy: Phase contrast, Fluorescence microscopy, Electron microscopy- Transmission and Scanning electron microscopes (TEM & SEM).

**Unit – II**

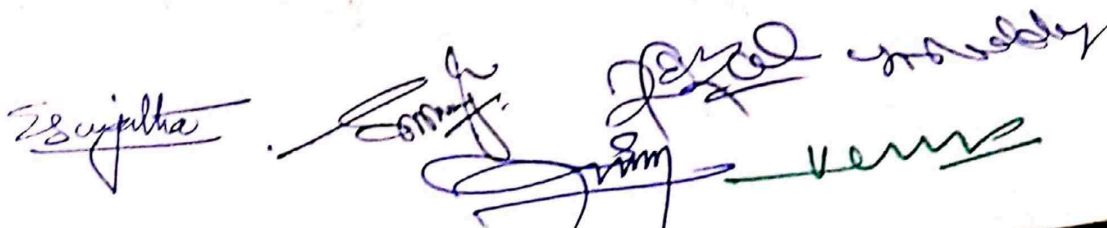
- a. Centrifugation techniques: Basic principles of centrifugation, standard sedimentation co-efficient and measurement of sedimentation co-efficient.
- b. Analytical and preparative centrifugation, differential, rate zonal and equilibrium density gradient centrifugation. Applications in determination of molecular weight.
- c. Chromatography: General principles. Types - partition, adsorption; paper and thin layer chromatography.
- d. Column chromatography, HPLC, GLC, Gel filtration, Ion exchange chromatography and Affinity chromatography.

**Unit – III**

- a. Electrophoresis: General principles, Types - moving boundary electrophoresis, paper electrophoresis, cellulose acetate, starch gel electrophoresis, polyacrylamide electrophoresis and agarose gel electrophoresis.
- b. Pulse-field gel electrophoresis, horizontal and vertical electrophoresis, two-dimensional electrophoresis, immune-electrophoresis, iso-electric focusing electrophoresis, capillary electrophoresis. Blotting techniques -Southern, northern and western blotting.
- c. Radioisotopic techniques: Principle and applications of tracer techniques in biology. Radioactive isotopes, Radioactive decay and commonly used isotopes in biology.
- d. Detection and measurement of radioactivity, Geiger-Muller counter, scintillation counter, Autoradiography, labeling procedures and safety aspects.

**Unit – IV**

- a. Spectroscopic techniques: Principle, simple theory of absorption of light by molecules, electromagnetic spectrum.





- b. Spectroscopy: The two most important tools used in nanotechnology research – Infrared spectroscopy and Raman spectroscopy.
- c. Instrumentation: Measuring the absorption and application of UV-visible spectrophotometer, Fluorescence spectroscope.
- d. Instrumentation: Measuring the absorption and application of NMR, ESR and Mossbauer spectroscopic method.

### Recommended Books

1. Hames, B.D. and Rickwood, D. 1990 Gel Electrophoresis A Practical Approach, Oxford University Press, New York.
2. Westermeier, R. 1993 Electrophoresis in practice VCH, Federal Republic of Germany.
3. Cotterill, R.M J. 2002 Biophysics An Introduction, John Wiley and Sons England.
4. Harrett, R.H. and Grisham C...M, 2004 Biochemistry III Ed. Cole publishing co. California.
5. Nolting, B. 2006 Methods in Modern Biophysics II Ed. Springer, Germany.
6. Pattabhi, V. and Goutham .N.2002 Biophysica Kluwer Academic Pub. New York
7. Wilson Keith and Walker John 2005 Principles and Techniques and Biochemistry and Molecular Biology VI Ed. Cambridge University press, New York.
8. Narayana .P. 2000 Essentials of Biophysics New Age International Pub. New Delhi.
9. Stephenson, F.H. 2003 Calculation in molecular biology and biotechnology Academic Press, Elsevier Science .London.
10. Keeler, J.2002 Understanding NMR spectroscopy. John Wiley and Sons England.
11. Cavangh John et al 1995 Proton NMR, Spectroscopy principles and practice, Academic Press.
12. Holme. D.J. and H. Peck. Analytical Biochemistry.
13. A. Upadhyay, K.Upadhyay and N. Nath 2006 Biophysical Chemistry, Principles and Techniques Himalaya Pub. House.
14. Slater, R.J. 1991 Radioisotopes in Biology. A practical Approach, IRL Press, Oxford.
15. Holler, F.J., D.A. Skoog and S.R. Crouch, 2007 Principles of Instrumental Analysis IV ED. Thomson, Brooks/Cole Pub. US
16. Richard Brooker and Earl Boysen (2006). Nanotechnology. Wiley Publishing Inc., India. Pp 361.
17. Reddy, SM and Ramchander M. 2020. Instrumentation in Biosciences. Scientific Publishers (India), Jodhpur.

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**FACULTY OF SCIENCE M.Sc. MICROBIOLOGY**  
**Semester –II**  
**Practical Syllabus Paper- IV**  
**MBP 206: BIOPHYSICAL TECHNIQUES & INSTRUMENTATION**

**Experiments**

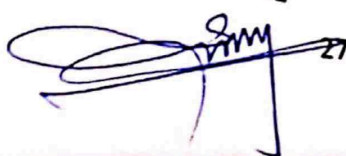
1. Determination of Pka value of amino acid
2. Determination of  $y_{\max}$  of a given solution
3. Separation of Carbohydrates by Paper Chromatography
4. Separation of Amino Acids by Paper Chromatography
5. Separation of Lipids by Thin Layer Chromatography
6. Demonstration of Column Chromatography
7. Verification of Lambert-Beers Law By UV-VIS Spectrophotometer
8. Separation of Proteins by Electrophoresis
9. Separation of DNA by Electrophoresis
10. Ultraviolet Spectroscopy of Proteins
11. Membrane separation-Dialysis.

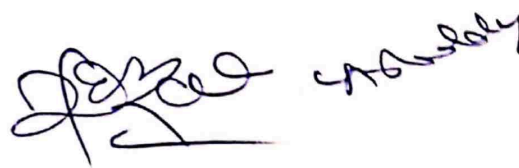
**Spotters**

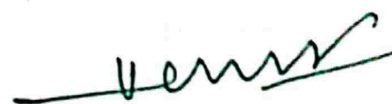
1. Gas Liquid Chromatography
2. Gel filtration Chromatography
3. Column Chromatography
4. HPLC
5. Ion Exchange Chromatography
6. Affinity Chromatography
7. Electrophoretic Unit
8. Banding pattern of Proteins (Gel image)
9. Banding patterns of DNA (Gel image)
10. Southern blotting
11. Northern blotting
12. Western blotting.
13. Centrifuge.
14. U.V spectrophotometer.
15. Fluorescence spectrophotometer.
16. Raman spectroscopy.













**KAKATIYA UNIVERSITY**  
**M.Sc. Microbiology Syllabus**  
**For the candidates admitted from the academic year 2021-2022**  
**For University College and affiliated colleges**

S. No	Paper Code	Title of Paper	Instruction Hours/week	No. of Credits	Marks		Total
					Internal Marks	External Marks	
Semester III							
1	MBT 301	Microbial Genetics & Genetic Engineering	4	4	20	80	100
2	MBT 302	Bioinformatics & Computational Methods	4	4	20	80	100
3	MBT 303	Bioprocess Technology	4	4	20	80	100
4	MBT 304	Agricultural Microbiology	4	4	20	80	100
5	MBP 305	Micro. Genetics & Genetic Engi. & Bioin. & Comp. Methods	6	4	-	100	100
6	MBP 306	Bioprocess Technology & Agri. Microbiology	6	4	-	100	100
7	MBS 307	Seminar/Tutorials	1	1		-	25
		Total		25			625
Semester IV							
1	MBT 401	Environmental Microbiology	4	4	20	80	100
2	MBT 402	Medical Microbiology	4	4	20	80	100
3	MBT 403	Microbial Technology	4	4	20	80	100
4	MBT 404	Pharmaceutical Microbiology	4	4	20	80	100
5	MBP 405	Environmental Microbiol. & Medical Microbiol.	6	4	-	100	100
6	MBP 406	Microbial Technology & Pharmaceutical Micbiol.	6	4	-	100	100
7	MBS 407	Seminar/Tutorials	1	1		-	25
		Total		25			625

**Semester-III**  
**Paper-I**  
**MBT 301: MICROBIAL GENETICS & GENETIC ENGINEERING**

**Unit- I**

- a. Genetic recombination in bacteria: Conjugation (including sexduction), Transformation and transduction; Models of homologous recombination - The Holliday model and Double strand break repair model. Site specific recombination.
- b. Gene mapping in prokaryotes: Deletion mapping, complementation, intragenic complementation, heteroduplex mapping, DNA foot printing, Chromosome walking and jumping.
- c. Plasmids: Types and Characteristics of plasmids, F plasmids, R-plasmids, Colicinogenic plasmids, Ti-plasmid and other plasmids, broad host range plasmids.
- d. Transposable elements: Types of Bacterial transposons, mechanism and types of transposition. Genetic phenomena mediated by transposons, transposons as genetic tools.

**Unit - II**

- a. Mutations: Types of mutagens (physical, chemical and environmental), mutagenesis, types of mutations; Molecular basis of mutations-frameshift mutations, transitions, transversions.
- b. Site-directed mutagenesis and its significance.
- c. Mutation screening in microorganisms: Evaluation of mutagens using microbial systems, Ames test, Replica Plating method, Antibiotic enrichment test and Chromogenic substrate test.
- d. Molecular methods for detection of mutations: Genotyping of Bacteria and Viruses, DNA sequencing, AFLP, RFLP and RAPD methods.

**Unit - III**

- a. Recombinant DNA technology: DNA manipulating enzymes, Restriction endonucleases - specificity, sticky ends and blunt ends.
- b. Cloning vectors: Plasmids, phasmids, phagemids, cosmids, YAC and BAC vectors and their advantages and disadvantages. Ligation, optimizing ligation conditions- linkers, adapters, homopolymer tailing.
- c. Selection of transformants: Insertion inactivation and Blue and white selection. Identification of cloned genes-colony hybridization.
- d. DNA libraries: Construction and screening of genomic libraries; isolation of mRNA, cDNA synthesis and cDNA libraries.

**Unit - IV**

- a. Polymerase chain reaction (PCR) technology: Theoretical aspects of PCR- PCR cycle, thermostable DNA polymerases, primers and their importance, optimizing the conditions for PCR, factors limiting PCR efficiency.
- b. Different versions of PCR: AP-PCR, Multiplex PCR, Broad range PCR, Inverse PCR, Nested PCR, Real time PCR and their applications; Applications of PCR technology- Forensic, clinical diagnosis, detection of pathogens in food, water; PCR in molecular evolution.
- c. Applications of rDNA technology in medicine and industry: Production of heterologous protein products, role of expression vectors, production of insulin, human growth hormone and hepatitis vaccine.
- d. Gene therapy: Inherited disorders, detection of gene defects, strategies for gene therapy- *in vivo* and *ex vivo* therapies. Gene delivery strategies: viral vectors and liposomes their advantages and disadvantages. Future prospects of gene therapy.



## Recommended Books

1. Brown, T.A. 1999 Gene Cloning. 3rd edition. Chapman and Hall Publications, USA.
2. Burrell, M.M. 1993. Enzymes of Molecular Biology, Humana Press.
3. Chirikjian, J.G. 1995 Biotechnology – Theory and Techniques, Vol. II, Jones and Bartlett Publishers.
4. Gerhardt, P. Murray, R.G., Wood, W.A., and Krieg, N.R. 1994 Methods for
5. 5 General and Molecular Bacteriology, ASM Press, Washington D.C.
6. Glick, B.R. and Pasternak, J.J. 1998 Molecular Biotechnology – Principles and Applications of
7. Recombinant DNA, ASM Press, Washington D.C.
8. Lewin, B. 2008 Genes IX. Oxford University Press, Oxford.
9. Murray Moo1992 Plant Biotechnology. Young, Pergamon Press.
10. Ratledge, C. and Kristiansen, B. 2001 Basic Biotechnology, II Edition, Cambridge University Press.
11. Winnacker, E.L. 1987 From genes to Clones: Introduction to Gene technology. V C H Publications,
12. Federal Republic of Germany.
13. Antony, J.F., Griffiths, Gilbert, W.M., Lewontin, R.C. and Miller, J.H. 2002 Modern genetic analysis,
14. Integrating Genes and Genomes, 2nd edition, WH Freeman and Company, New York.
15. Blackburn, G.M. and Gait, M.J. 1996 Nucleic acids in chemistry and biology. Oxford University Press.
16. Molecular Biology of cell. Albert *et al.*, 4th Edition Garland Publishing Inc.
17. George M. Malacinski, David Freifelder. 1998 Essentials of Molecular Biology. Jones and Bartlett
18. Publishers.
19. Maloy, S.R., Cronan, J.R. Freifelder, D. 1994 Microbial Genetics, Jones and Bartlett Publishers.
20. Macinski, G.M. and Freifelder, D. 1998 Essentials of Molecular Biology, 3rd Edition, John and Bartlett
21. Publishers.
22. Sir John Kendrew 1994 The Encyclopedia of Molecular Biology. Blackwell Science Ltd
23. Watson, J.D., Hopkins, N.H., Roberts, J.W., Steitz, J.A. and Weiner, A.M. 1998 Molecular Biology of
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24. Gene, 4th edition, Benjamin/Cummings publishing company.
25. Freifelder, D. 1997 Essentials of Molecular Biology. Narosa Publishing House, New Delhi.
26. Freifelder, D. 1990 Microbial Genetics. Narosa Publishing House, New Delhi.
27. Snyder, L. and Champness, W. 1997 Molecular Genetics of Bacteria. ASM press, USA.
28. Maloy, S.R., Cronan, J.E. and Freifelder, D. 1994 Microbial Genetics, Jones and Bartlett Publishers,
29. London.
30. Turner, P.C., McLennan, A.G., Bates, A.D. and White, M.R.H. 1998 Instant Notes in Molecular Biology,
31. Viva Books Pvt., Ltd., New Delhi.
32. Twynan, R.M. 2003 Advanced Molecular Biology. Viva books Pvt. Ltd. New Delhi.
33. Ram Reddy S, Venkateshwarlu K and Krishna Reddy V 2007 A Text Book of Molecular Biotechnology
34. Himalaya Publishers Hyderabad
35. Old, R.W. and Primrose, S.B. 1994 Principles of Gene Manipulation, Blackwell Science Publication.

## Semester - III Paper-II

### MBT 302: BIOINFORMATICS & COMPUTATIONAL METHODS

#### Unit – I

- a. Bioinformatics: definition, concept, scope, relevance of bioinformatics, development of bioinformatics, applications of bioinformatics. Operating systems (Linux) and programming languages (Perl, CORBA) in bioinformatics.
- b. Databases: Gene banks, objectives, types of databases- flat files, relational databases, objective oriented databases, hypertext databases, web interfaces; Resource databases- Generalized (DNA, protein) and specialized databases.
- c. Search tools: Data mining, BLAST and FASTA.
- d. Sequence analysis of biological data: terminology, methods for alignment- pairwise & multiple sequence alignments, algorithm for alignment of sequencing fragments

#### Unit – II

- a. Phylogenetic analysis: Concept of phylogenetic trees, phylogenetic trees and multiple alignment methods - distance matrix, character based evaluation of methods, evaluation of phylogenies, steps in constructing alignments and phylogenies, working with phylogeny trees- with suitable software-EMBOSS

- b. Gene prediction: Approaches and methods, tools- GRAIL, GenLang, BCM GeneFinder, Procrustes, GeneParser. Prediction of protein structure- Methods for structure prediction for known and unknown folds, prediction of protein function.
- c. Genomics: Gene mapping, sequence assembly and gene expression, DNA microarrays, microarray design and data analysis.
- d. Proteomics: Definition, proteome analysis; tools for proteome analysis, protein-protein interactions; metabolic and genetic networks, concept of E- cell.

### **Unit – III**

- a. Biostatistics: Definition, scope, applications in biology, terminology; sampling techniques- random and non-random methods.
- b. Measures of central tendencies: Mean, mode, median, standard error and standard deviation.
- c. Probability: Concepts, terminology, kinds of probabilities, theorems of probability, normal, binomial and poisson distribution.
- d. Chi Square test: Characteristics of chi-square test, degrees of freedom, test of goodness of fit, null hypothesis.

### **Unit – IV**

- a. Analysis of variance (ANOVA): Methods of ANOVA, one way and two way classifications, F-test, steps involved in ANOVA, importance of ANOVA.
- b. Correlation: Definition, methods of studying the correlation, types of correlations-scatter diagram, Karl Pearson's efficient of correlation and rank correlation method.
- c. Regression: Definition, types of regression analysis, regression equation, methods of studying regression, graphic and algebraic methods, importance of regression.
- d. Importance of statistical software in data analysis.

## **Recommended Books**

1. Andreas D. Baxevanis, B.F. Francis Ouellete. 2004 Bioinformatics A practical guide to the analysis of genes and proteins,
2. Attwood, T.K. and D.J Parry-Smith. Introduction to Bioinformatics
3. Bishop, M. J. and C.J. Rawlings Nucleic acid and protein sequence analysis-A practical approach
4. Blinks, C.K 1967 Statistics in biology vol 1 Mc Graw Hill, New York
5. Brown, T.A Genomes John Wiley & Sons Asia Pte. Ltd. 1999
6. Campbell RC 1974 Statistics for Biologists Cambridge university press
7. Chritine Orenge, David Jones, Janet Thornton. Bioinformatics: genes, proteins and computers
8. Cynthia and Perk Jambeck Bioinformatics computer skills, Wiley
9. Dan E. Krane, Michael Raymer. 2003 Fundamental Concepts of bioinformatics,
10. David Mount. 2003 Bioinformatics sequence and genome analysis
11. Hewitt.W 1977 Microbiological assay Academic press, New York
12. Higgins, W. Taylor. Bioinformatics: Sequences, structure and databanks- A practical approach,
13. Jean-Michel claverie, Cedric Notredme Bioinformatics A Beginner's Guide, Wliiey Publication
14. Jonathan Pevsner. 2004 Bioinformatics and Functional Genomics
15. Stephen Misener and Stephen A. Krawetz. Bioinformatics methods and protocols
16. Wardlaw, AC 1985 Practical statistics for experimental Biologists.

## **Semester - III**

## **Paper - III**

## **MBT 303: BIOPROCESS TECHNOLOGY**

### **Unit – I**

- a. An overview of fermentation technology, range of fermentation processes, primary and secondary metabolites, components of fermentation process.
- b. Industrial microorganisms: isolation, preservation, screening and strain improvement and maintenance.
- c. Formulation of industrial media: Medium requirements for fermentation processes, carbon, nitrogen, mineral sources, buffers, antifoam agents, medium optimization.
- d. Stoichiometry of cell growth and product formation, Sterilization of media and fermenters,

scale – up process and starter culture technology

## Unit – II

- a. Basic design of a microbial fermentor, types of fermentation vessels. aseptic operation, containment,
- b. Body construction (stirrer glands, bearing, valves, steam traps) baffles, spargers and impellers.
- c. Types of fermentations: batch, continuous, fed-batch, solid state, sub-merged.
- d. Aerobic and anaerobic, dual and multiple fermentations, their advantages and disadvantages.

## Unit – III

- a. Importance of downstream processing in industrial fermentation processes. Problems and requirements of bio product recovery and purification.
- b. Physico- chemical basis of bio separation processes.
- c. Fermentation economics - Market potential, some effects of maintenance legislation on production of antibiotics and recombinant proteins, plant and equipment.
- d. Continuous culture, recovery costs, water usage and recycling and effluent treatment.

## Unit – IV

A brief out lines of processes for the production of the following commercially important products:

- a) Primary metabolites
  - i. Organic acids : Citric acid, Lactic acid,
  - ii. Amino acids : Glutamic acid, L-lysine,
  - iii. Solvents : Acetone, Ethyl alcohol
- b) Secondary metabolites
  - i. Antibiotics : Streptomycin, Penicillin
  - ii. Vitamins : B<sub>12</sub>, Riboflavin,
  - iii. Biofuels : Hydrogen, Methane

## Recommended Books

1. Ali Cinar, Satish J. Parulekar, Cenk Undey, Birol Gulnur 2003 Batch Fermentation: Modeling, Monitoring, and Control Marcel Dekker Inc
2. Berry, D.R. (Ed) 1998 Physiology of Industrial fungi BSP, Oxford University.
3. Crueger & Crueger Biotechnology: A Text Book of Industrial microbiology 2nd edition
4. Dellweg .Biotechnology Vol III.
5. Demain, A.L. Biology of Industrial Microorganisms
6. Diliello Methods in Food and Dairy Microbiology
7. Harold B. Reisman 1988 Economic Analysis of Fermentation Processes CRC Pr I Llc
8. Henry, C. Vogel and L. Celeste Todaro 2005 Fermented and Biochemical Engineering Hand Book 2ed Standard Publishers Distribution New Delhi
9. Coeplor, S.H. and D.Perhman Encyclopedia of Industrial microbiology Vol. I & II
10. Patel, A.H. Industrial microbiology
11. Peppler & Pearlman .Microbial Technology Vol I & Vol II .
12. Prescott & Dunn, Industrial microbiology,
13. Prescott & Dunn's Fundamentals of Applied Microbiology (2nd edition)
14. Rao. D.J. 2005 Intriducion to Biochemical Engineering McGraw-Hill
15. Reed, G. Industrial Microbiology, CBS Publishers

## Semester - III

### Paper- IV

## MBT 304: AGRICULTURAL MICROBIOLOGY

### Unit - I

- a. Natural and man engineered ecosystems - suitability of soil for agriculture, soil chemistry, humus formation, soil fertility, micro/macro nutrients, frequency/density and abundance of soil microbes, biological significance of soil enzymes.



- b. Global nitrogen cycle – microbiology and ecological importance of ammonification, nitrification and denitrification – organisms that fix atmospheric nitrogen (free living, aerobic, symbiotic, endophytic bacteria).
- c. Biology of nitrogen fixation – Physiology of legume root nodule, leghaemoglobin synthesis, biochemistry and genetics of symbiotic and asymbiotic nitrogen fixation, action of nitrogenase and hydrogenase.
- d. Rhizosphere – Nature, extent, influence of root exudates on microflora, plant growth promoting rhizobacteria (PGPR) and siderophore production, nature and ecological significance of ectotrophic and endotrophic mycorrhizal associations, role of microbes in transformation of phosphorus, sulphur and iron.

## Unit - II

- a. Principles of plant disease resistance, entry and establishment of pathogens in plants, host-parasite interaction, role of enzymes and toxins in pathogenesis.
- b. Protection and defense, mechanism of disease resistance (performed and induced defense, local signals), programmed cell death, induced structural barriers, phytoalexins.
- c. Biochemical basis of disease resistance – Systemic acquired resistance (SAR), Local acquired resistance (LAR) and Pathogenesis related proteins (PR-proteins) - chitinases and glucanases.
- d. Transgenic Resistance - horizontal and vertical resistance, classification and functions of resistance genes, transformation for disease resistance, Bt genes and resistance to insects.

## Unit - III

- a. Plant disease triangle, disease forecasting, reproduction, inoculum, virulence, dissemination.
- b. Symptoms, disease cycle and management of the following plant diseases: Fungal diseases – late blight of potato, downy mildew of grapes, loose smut of wheat, smut of bajra, covered smut of barley, blast disease of paddy, red rot of sugarcane.
- c. Bacterial diseases – bacterial blight of paddy, angular leaf spot of cotton, common scab of potato.
- d. Viral diseases – tobacco mosaic, leaf curl of tomato, yellow vein mosaic of bhindi.

## Unit - IV

- a. Cultural methods, agronomic practices (crop rotation, field and crop sanitation), chemical control (fungicides, fumigants, inorganic copper/sulphur compounds, dithiocarbamates)
- b. Organic agriculture and disease control – Biofertilizers – development and the concept, *Rhizobium*, *Bradyrhizobium*, *Azotobacter*, *Azospirillum*, *Acetobacter*, *Frankia*, algal fertilizers, mass cultivation techniques, quality control of biofertilizers, field performance of biofertilizers, problems and prospects.
- c. Microbial pesticides – development and significance, source organisms, Bacteria – *Bacillus thuringiensis*, Bt based commercial products, other bacilli producing pesticides, Fungi – *Beauveria bassiana*, *Metarhizium anisopliae*, *Trichoderma viride*, Viruses - Baculo virus for insect pest control (NPV – Nuclear Polyhedrosis Virus).
- d. Post harvest diseases and their control – microbial spoilage of fruits and vegetables, stored grains/seeds, mode of infection and factors influencing post-harvest diseases, strategies for post-harvest disease control through fungicides, irradiation, fumigation and vapor heat treatment.

## Recommended Books

1. Agrio, G.N. Plant pathology
2. Alexander, M Soil Microbiology
3. Benjamin Cunnings, Merio pank. California 1987 Microbial ecology, fundamentals an application
4. Bilgrami, K.S. and H.C. Dube Modern Plant pathology
5. Biofertilizers by N.S. Subba Rao
6. Lynch J.M. Soil Biotechnology
7. Lynch Poole Microbial Ecology: A conceptual approach
8. Mehrotra, R.S. Plant Pathology

9. Microbial ecology: Principles, methods & applications & Biological nitrogen fixation.
10. R.S. Singh An introduction to principles of plant pathology
11. Rangaswami, G. and A. Mahadevan Diseases of crop plants
12. Rangaswamy, G and. Bhagyaraj D.J .Agricultural Microbiology by
13. Richard, B.N. An introduction to soil ecosystem
14. Singh, R.S. Plant diseases R
15. Stolop H. Microbial Ecology: Organisms, habitats, Activities
16. Subba Rao N. S Advances in Agriculture Microbiology by
17. Subba Rao, N.S. Soil microorganisms and plant growth
18. Tarr, S.A.J. Principles of plant pathology
19. Vander Plank Plant disease resistance
20. Vidyasekaran Molecular plant pathology

### **Semester- III** **Practical Paper – I**

#### **MBP 305: MICROBIAL GENETICS & GENETIC ENGINEERING & BIOINFORMATICS & COMPUTATIONAL METHODS**

1. Isolation of auxotrophic mutants by Replica plate technique
2. Mutagenesis and UV survival curve
3. Isolation of petite mutants
4. Restriction analysis of DNA and agarose gel electrophoresis
5. Diauxic growth experiment
6. Preparation of competent cells
7. Transformation- selection of recombinants-Blue and white selection(X-gal method)
8. Amplification of DNA by PCR
9. Problems related to
  - (a) Mutation (b) Recombination(Conjugation, transformation, transduction), (c) Gene mapping (d) Restriction mapping (e) Primer design and PCR amplifications (f) DNA libraries.
10. Aligning sequences using Clustal-X
11. Sequence data retrieval in FASTA format from NCBI database.
12. Similarity search in BLAST for protein or nucleotide sequence.
13. Prediction of secondary structure of protein
14. Viewing the Protein Data Box (PDB) files using Rasmol software.
15. Conversion of raw sequences into different sequence format by using Read Seq Tool.
16. Problems on mean, mode, median, standard deviation and standard error
17. Problems on probability distributions
18. Problems on Chi-square test
19. Problems on one way and two-way ANOVA and F-test analysis
20. Problems on Karl Pearson Correlation coefficient and Rank Correlation coefficient
21. Problems on Regression analysis

### **Semester- III** **Practical Paper- II** **MBP 306: BIOPROCESS TECHNOLOGY**

1. The use of Logarithms in Microbial growth study, in fermentation process.
2. Determination of the midpoint of the Logarithmic phase of microbial growth in fermentation process.
3. Harvesting the microbial cells and determination of the yield of Fermentation products.
4. Manometric study in Fermentation process.
5. Isolation and identification of secondary metabolites in the fermentation process.
6. Design and construction of microbial fermentor.
7. Screening of microorganisms through war cup method in strain improvement.
8. Production and estimation of streptomycin.
9. Production and estimation of Lactic acid.
10. Production and estimation of Ethyl alcohol.

11. Production and estimation of Penicillin.
12. Production and estimation of Indole Acetic Acid (IAA).
13. Estimation of Cynacobalamine (Vitamin B12).

**Spotters:**

- |                         |                          |
|-------------------------|--------------------------|
| 1. Design of fermenter  | 8. Baffles               |
| 2. Seed Flask           | 9. Impellers             |
| 3. Seed fermenter       | 10. Bread                |
| 4. Production fermenter | 11. Monometric fermenter |
| 5. Air sparger          | 12. Strain improvement   |
| 6. Foam breaker         | 13. Immobilized beads    |
| 7. Stirrer gland        |                          |

**Semester- III**  
**Practical Paper- II**  
**MBP 306: AGRICULTURAL MICROBIOLOGY**

1. Solubilization of rock phosphate by microorganisms
2. Estimation of organic matter in agricultural soils to assess the soil fertility
3. Estimation of cell wall degrading enzymes : cellulases (exo-and endo-glucanases), polymethyl esterase, poly galacturonase, pectic lyase in hostpathogen interactions
4. Estimation of accumulated soil enzymes : catalase/peroxidase, phosphatase, urease,
5. Isolation and identification of cyanobacteria used as biofertilizers- *Nostoc*, *Anabaena*, *Scytonema*
6. Isolation of *Rhizobium* from root nodules
7. Classification and symptomology of plant diseases covered in theory (unit III)
8. Determination of Disease Tolerance Index (DTI) in crop plants
9. Biochemical changes in healthy and diseased crop plants: carbohydrates, proteins, amino acids, chlorophyll
10. Quantification of phytoalexins in healthy and diseased crop plants
11. Analysis of PR proteins in healthy and diseased plants through electrophoresis
12. Enumeration of Rhizosphere microflora and comparison with normal soil microflora
13. Enumeration of ammonifiers, nitrifiers and denitrifiers in soil samples
14. Assay of fungicides by humid chamber technique and calculation of LD50 value
15. Section cutting of infected plant parts.

**Spotters:**

- |                                 |                                  |
|---------------------------------|----------------------------------|
| 1. Downy mildew of peas         | 15. Bacterial blight of paddy    |
| 2. Downy mildew of bajra        | 16. Citrus canker                |
| 3. White rust of crucifers      | 17. Angular leaf spot of cotton  |
| 4. Powdery mildew of cucurbits  | 18. Stalk rot of maize           |
| 5. Rust of beans                | 19. Sesamum phylloidy            |
| 6. Rust of pea                  | 20. Tobacco mosaic virus         |
| 7. Rust of ground nut           | 21. Yellow vein mosaic of bhendi |
| 8. Whip smut of sugarcane       | 22. <i>Nostoc</i> ,              |
| 9. Wilt of pigeon pea           | 23. <i>Anabaena</i> ,            |
| 10. Wilt of cotton              | 24. <i>Scytonema</i>             |
| 11. Root rot of cotton          | 25. <i>Rhizobium</i>             |
| 12. Stem rot of rice            | 26. Ammonifiers,                 |
| 13. Brown spot diseases of rice | 27. Nitrifiers                   |
| 14. Blast diseases of rice      | 28. Denitrifiers                 |



**Semester-IV**  
**Paper- I**  
**MBT 401: ENVIRONMENTAL MICROBIOLOGY**

**Unit - I: Microbial Diversity**

- a. Introduction to Microbial Diversity, types of micro-organisms - bacteria, archeobacteria, eucarya, interaction between microorganisms, microbial succession.
- b. Extremophiles – Habitat, effect of extreme conditions on cellular components, membrane structure, nucleic acids and proteins, adaptation mechanisms in micro-organisms in diverse environments.
- c. Study of thermophiles, psychrophiles, halophiles, piezophiles, acidophiles, alkalophiles, xerophiles, radiation resistant organisms, methanogens.
- d. Biotechnological applications of extreme proteins from above groups, Geomicrobiology – biofouling, biocorrosion.

**Unit - II: Soil Microbiology**

- a. Principles and concepts of soil microbiology: soil principles and properties – soil formation, texture, composition, characteristics, density and biomass of microbes in soil, terrestrial carbon cycles, soil fertility.
- b. Decomposition of organic matter – litter chemistry, carbon assimilation and immobilization, dynamics of organic matter, accumulated soil enzymes and their role in soil development.
- c. Bioremediation of polluted soils – Microbes in polluted soils, strategies of their survival, mechanisms of the degradation of pesticides, biohydrometallurgy using recombinant microbes for recovery of precious metals.
- d. Microbial leaching and biomining (copper and uranium) – dump, heap and agitated leaching, chemistry and microbiology of bioleaching, biomining (*ex situ* and *in situ* – hole to hole leaching), plasmids and genes in biomining.

**Unit - III: Water Microbiology**

- a. Principles and concept of Water Microbiology: Global water reserves, physical/chemical/biological/microbiological characteristics of water, water consumption cycle, biomonitoring of the aquatic environment, pollution indices, eutrophication.
- b. Waste water treatment through aerobic microorganisms – Biological filters, aeration tanks, activated sludge, biological ponds, irrigation fields.
- c. Waste water treatment through anaerobic microorganisms – septic tanks, imhoff's tank, upflow anaerobic sludge blanket (UASB), anaerobic filters, anaerobic attachment film expanded bed (AAFEB), anaerobic rotating biological contractor.
- d. Pollution control biotechnology – commercial blends of microorganisms and enzymes, immobilized cells and enzymes, biotechnological approaches for recovery of useful products from sewage and industrial wastes (methane).

**Unit - IV: Microbiology of Air**

- a. Historical introduction – Nomenclature of atmospheric layers, microbes as source and sink of atmospheric pollutants, pollutant transformation by microbes, air borne microbes and their reservoirs, bioaerosols.
- b. Air sampling techniques – slit samples, cascade impactor, hirst trap, anderson's air sampler, vertical cylinder trap, burkard trap. The impingers – proton impinger and pre-impinger.
- c. Air quality in Indian cities – mapping of the hot spots, air quality monitoring and measurement, impact of air-borne microorganisms on living beings, fungal allergy, immediate/delayed type of hypersensitivity, atopic allergy.
- d. Air sanitation – control of air borne pathogens, irradiation, chemical disinfection, dust control. Biotechnological methods for the abatement of environmental bio-pollution.

## Recommended Books

- |                                |   |
|--------------------------------|---|
| 1. Alexander M.                | Soil Microbiology                           |
| 2. Anil Prakash (Ed.)          | Fungi in Biotechnology                      |
| 3. Atlas & Batra               | Microbial Ecology                           |
| 4. Benjamin Cunnings           | Microbial Ecology                           |
| 5. Burns R.G & J.H.Slater      | Experimental Microbial Ecology -            |
| 6. Gabriel Bitton              | Wastewater Microbiology                     |
| 7. Gilbert S. Omen             | Environmental Biotechnology                 |
| 8. Gray T.R.G.&S.T.Williams    | Soil Microorganisms                         |
| 9. Gregory P.H.                | The Microbiology of Atmosphere              |
| 10. Lautit M.W&C.M.Eds.Keuin   | Microbial Ecology Proc.                     |
| 11. Lynch J.M                  | The Rhizosphere                             |
| 12. Lynch J.M and N.J. Poole   | Microbial Ecology: A conceptual approach    |
| 13. Michael S.Switzerbaury(Ed) | Anaerobic Treatment of Sewage               |
| 14. Mishra R.R                 | Soil Microbiology                           |
| 15. Odum E.P.                  | Fundamentals of Ecology                     |
| 16. Omenn G.S.& M. Alexander   | Genetic control of Environmental Pollutants |
| 17. Ralph Mitchell             | Environmental Microbiology                  |
| 18. Ratledge C.                | Biochemistry of Microbial degradation       |
| 19. Spani J.C.                 | Biodeterioration of non-aromatic compounds  |
| 20. Subba Rao N.S.             | Soil Microbiology                           |
| 21. Thomas D. Brook            | Thermophiles                                |
| 22. Tilak S.T                  | Environmental Biopollution                  |
| 23. Williams G.C               | Biofilms                                    |

## Semester - IV

### Paper - II

## MBT 402: MEDICAL MICROBIOLOGY

### Unit – I

- History of medical microbiology. General attributes and virulence factors of bacterial and viral infections.
- Diagnosis of infectious diseases: Types of specimens, specimen collection, transport and processing of material, culture isolation and identification for microbiological diagnosis.
- Immunodiagnosis: Immunological assays, Serological tests and Immunoblotting.
- Molecular diagnosis: Nucleic acid hybridization techniques, PCR, Transcription Mediated Amplification (TMA), Nucleic acid Sequence Based Amplification (NASBA), Ligase chain reaction.

### Unit – II

Morphology, cultural characteristics, antigenic structure, pathogenicity, clinical symptoms, laboratory diagnosis, prevention-control and treatment of diseases caused by the following organisms

- Air borne infections: *Streptococci*, *Corynebacterium diphtheria*, *M. tuberculosis* and *N. meningitis*
- Water born infections: *E. coli*, *Salmonella*, *Shigella*
- Wound infections: *Clostridium tetani*, *Staphylococci*, *Pseudomonas*.
- Sexually transmitted diseases: *Treponema*, *Neisseria gonorrhea*, LGV agent, *Chlamydiae*, and *Haemophilus ducreyiei*.

### Unit – III

Study of etiology, cultivation, antigenic structure, pathogenesis, laboratory diagnosis, prevention and treatment of

- a. Airborne infections: *Influenza virus, Rhinovirus, Adenovirus, Mumps, Measles.*
- b. Zoonotic viral infections: *Rabies virus, Japanese encephalitis*
- c. Water born, contact and sexually transmitted diseases: *HAV, HBV, Entero virus, HSV, HIV*
- d. Mode of action of antimicrobial drugs on cell wall, nucleic acids, protein synthesis, enzyme inhibitors, cell membrane disruptors, anti-metabolites, Drug resistance and side effects.

#### Unit - IV

- a. Study of etiology, pathogenesis, epidemiology and prevention of Amoebiasis, Malaria, Ascariasis, Ancylostomiasis and Filariasis.
- b. Study of etiology, pathogenesis, epidemiology and prevention of Dermatophytosis (*Microsporum, Trichophyton* and *Epidermophyton*) and sub-cutaneous (Sporothrix, Mycetoma).
- c. Endemic mycosis: Coccidiomycosis, Histoplasmosis.
- d. Opportunistic mycosis: Candidiasis, Cryptococcosis, Aspergillosis.

### Recommended Books

1. Arnold, 1998 Medical Microbiology, Volume 4
2. Bernard, Davia, Dulbecco Microbiology (4<sup>th</sup> edition)
3. Blackwell, 1993. Modern Parasitology : A Text Book of Parasitology (2<sup>nd</sup> Ed.) Cox FEG,
4. Brooks, G.F., J.S. Butel and S.A. Morse, Mc Graw – Hill Medical Microbiology
5. Christie AB, Edinburgh, Churchill – Livingstone Infectious diseases : Epidemiology and clinical practice (4<sup>th</sup> ed.)
6. Chung KJ, Bennett JE, Lea & Febiger, 1992 Medical Mycology
7. Kwon – Topley & Wilson's Microbiology and Microbial infections (9<sup>th</sup> Ed.) Ajello L, Hay
8. Churchill Livingstone, Davies et al 2<sup>nd</sup> edition. Microbiology
9. Churchill Livingstone, 1996 Practical Medical Microbiology (14<sup>th</sup> ed.)
10. Cruickshank Medical Microbiology Vol. I and II
11. DH et al (ed.) American Society for Microbiology, 1993 Diagnostic Molecular Microbiology,
12. Evans EGV et al (ed.) Medical Mycology, Oxford : Oxford University Press.
13. Jawetz, Melnick & Adebery Reviews of Medical Microbiology
14. Jayaram Paniker. Text book of Medical parasitology (4<sup>th</sup> edition)
15. Jhon Bernard Clinical diagnosis and management – Laboratory methods
16. Joklik, Wille, Amos & Wilfert Zinser Microbiology
17. Longman, 2000 Test Book of Microbiology
18. Macowiak PA N. Engl J. Med. 1982 The normal microbial flora 307: 83
19. Mandell, Douglas and Bennett's 2000 Principles and Practice of infectious diseases 5<sup>th</sup> edition
20. Mosby Bailey and Scott's Diagnostic microbiology
21. Murray PR et al (Ed.) American Society for Microbiology 1999 Manual of clinical Microbiology
22. Panjarathinam R Orient Longman. Text book of Medical Parasitology. Principles and Applications,
23. Reppon JW, Philadelphia: WB Saunders, 1988 Medical Mycology,
24. Richmann, DD et al Churchill Livingstone, 1997 Clinical virology,
25. Skinner, FA and Carr, JG (ed.) 1974 The Normal Microbial Flora of Man, Academic Press,
26. Yu VL, Merrigan TC Jr. Barriere William & Wilkins, 1999 Antimicrobial therapy and vaccines
27. Franklin, T.J. and G.A. Snow 2008 Biochemistry and Molecular Biology of Antimicrobial Drug Action. Springer International Edition England
28. Medical Microbiology by Sherries

### Semester - IV

#### Paper - III

### MBT 403: MICROBIAL TECHNOLOGY

#### Unit – I

- a. Microbes important in food microbiology: yeasts, filamentous fungi and bacteria contamination of foods.
- b. Factors influencing food spoilage (intrinsic and extrinsic)
- c. Food poisoning and food borne infections (bacterial, viral, fungal and protozoa),



bacterial and fungal toxins.

- d. Detection of microbial contamination of foods: Direct microscopic count (DMC), standard plate count, MPN method, reductase tests, membrane filters and molecular methods

## **Unit – II**

- a. Contamination and spoilage of cereals, cereal products, fruits, vegetables, meats, meat products, fish, sea foods, eggs, poultry and canned foods.
- b. General principles of food preservation- Physical and Chemical methods.
- c. Dairy microbiology: Normal flora of milk and milk products, Spoilage of milk and milk products. Fermented milk products: acidophilus milk, bifidus milk, yoghurt manufacture of cheese, evolution of quality milk
- d. Microbial food fermentation: Fermentation in food processing, role of microorganisms in food fermentation. Microbial products of food; SCP, mushrooms, oriental foods Fermented beverages (fruit and cereal based) and fermented meat and meat products.

## **Unit – III**

- a. Yeasts fermentation and yeast products: Production of active dry baker's yeast, instant yeast, quality of baker's yeast, production of brewer's yeast, wine yeast food and fodders yeast.
- b. Industrial production of enzymes: cellulases, amylases, proteases, phytases, pectinases, lipases, glucose isomerases, Immobilization of enzymes and cells and their applications.
- c. Scope, utility and methodology of biotransformation, biotransformation of antibiotics, steroids and non – steroids.
- d. Probiotics and Synbiotics. Food sanitation, food control agencies and their regulations.

## **Unit – IV**

Industrial production of

- i) Biopesticides – Bacterial, viral and fungal
- ii) Biofertilizers – Nitrogen fixers, PSM, mycorrhizae
- iii) Biopolymers – Extracellular polymers, xanthans, dextrans, poly  $\beta$  hydroxyl alkanates
- iv) Biosurfactants - Classification, production and application
- v) Vaccines – Bacterial and viral vaccines.

### **Recommended Books**

1. Adams, M.R. and Moss. M.O. 2007 Food Microbiology Royal society of Chemistry Pub Cambridge.
2. Banwart, G.S. 1989 Basic Food Microbiology
3. Chaplin, M.F. & Bucke, C. 1990 Enzyme Technology Cambridge.
4. Diliello Methods in Food and Dairy Microbiology
5. Ealters, R.W. (Ed) 1992 Vaccines: New Approaches to immunological problems, B.H. London.
6. Fellows P. J 2009 Food Processing Technology Principles and Practice, Third Edition Published by: CRC Press
7. Frazier, W.C. and Werthaff, D.C. 1998 Food Microbiology 4th edition. Tata Mc Grow Hill New Delhi
8. [http:// WWW.sallys-place.com/beverages/beer/beer\\_is\\_made.htm](http://WWW.sallys-place.com/beverages/beer/beer_is_made.htm)
9. <http://WWW.Indianfoodindustry.net/>
10. Hui Y H 2006 Food Biochemistry and Food Processing Blackwell
11. Jay. J.M. 1991 Modern food microbiology. 4<sup>th</sup> ed Van Nostrand Reinhold Co. New York.
12. Joshi, V.K. Ashok Pondey 1999 Biotechnology and Food fermentation Vol. I & II.
13. Katherine Smart 2003 Brewing Yeast Fermentation Performance John Wiley & Sons Inc
14. Prescott and Dunn's, Industrial Microbiology 4<sup>th</sup> edition.
15. Robison, R.K. 1990 Dairy Microbiology.
16. Thomas J. Montville, Karl Matthews, 2005 Food Microbiology: An Introduction: Amer Society for Microbiology

**Semester – IV**  
**Paper – IV**  
**MBT 404: PHARMACEUTICAL MICROBIOLOGY**

**Unit I**

- a. Microorganisms affecting pharmaceutical industry – The atmosphere, water, skin & respiratory flora of personnel, raw-materials, packing, equipments, building, utensils etc.
- b. Types of microorganisms occurring in pharmaceutical products. Microbiological spoilage prevention of pharmaceutical products.
- c. Preservation of pharmaceutical products; antimicrobial agents used as preservatives, evaluation of the microbial stability of formulation.
- d. Sterilization in pharmaceutical industry. Good manufacturing practices in pharmaceutical industry

**Unit II**

- a. History of chemotherapy – plants and arsenicals as therapeutics, Paul Ehrlich and his contributions, selective toxicity and target sites of drug action in microbes.
- b. Development of synthetic drugs – Sulphanamides, antitubercular compounds, nitrofurans, nalidixic acid, metronidazole group of drugs.
- c. Antibiotics - The origin, development and definition of antibiotics as drugs, types of antibiotics and their classification. Non-medical uses of antibiotics.
- d. Cosmetics microbiology- testing methods and preservation. Antimicrobial preservation efficacy and microbial content testing

**Unit III**

- a. Principles of chemotherapy – Clinical and lab diagnosis, sensitivity testing, choice of drug, dosage, route of administration, combined/mixed multi drug therapy, control of antibiotic/drug usage.
- b. Mode of action of important drugs – Cell wall inhibitors (Betalactam – eg. Penicillin).
- c. Bacterial resistance to quinolones. membrane inhibitors (polymyxins), macromolecular synthesis inhibitors (streptomycin), antifungal antibiotics (nystatin)
- d. Rapid screening of multi drug resistant bacterial genes from different sources

**Unit IV**

- a. The drug resistance – The phenomenon, clinical basis of drug resistance, biochemistry of drug resistance, genetics of drug resistance in bacteria.
- b. Microbiological assays: Assays for growth promoting substances, nutritional mutants and their importance, vitamin assay, amino acid assay
- c. Assay for growth inhibiting substances – Assay for non-medicinal antimicrobials (Phenol coefficient/RWC). Drug sensitivity testing methods and their importance. Assay for antibiotics –
- d. Determination of MIC, the liquid tube assay, solid agar tube assay, agar plate assay (disc diffusion, agar well and cylinders cup method). Introduction to pharmacokinetics and pharmacogenomics.

**Recommended Books**

1. Disinfection, sterilization and preservation. Block, S.S. (ed). Lea and Febigor, Baltimore
2. Pharmaceutical Microbiology. Huge, W.B. and Russel, AD. Blackwell Scientific, Oxford
3. Principles and methods of sterilization in health sciences. Perkins, JK. Pub: Charles C. Thomas, Springfield.
4. American Public Health Association, Washington, D.C. Disinfectants: Their use and evaluation of effectiveness. Collins, CH., Allwood, MC, Bloomfield, SF. And Fox, A. (eds). Pub: Academic Press, New York
5. Inhibition and destruction of microbial cell by Hugo, WB. (ed). Pub: Academic Press, NY
6. Manual of Clinical Microbiology. Lennette, EH. (ed). Pub: American Society for Microbiology, Washington.

7. Principles and Practices of disinfection. Russell, AP., Hugo, WB., and Ayliffe, GAJ. (eds). Publ. Blackwell Sci.
8. Biochemistry of antimicrobial action. Franklin, DJ. and Snow, GA. Pub: Chapman & Hall.
9. Antibiotics and Chemotherapy. Garrod, L.P., Lambert, HP. And C'Grady, F. (eds). Publ: Churchill Livingstone.
10. Antibiotics. Lancini, G. and Parenti, F. Pub: Springer-Verlag.
11. The Molecular Basis of antibiotic action. Gae, EF. et al. Publ: Wiley, New York.
12. Antimicrobial Drug action. Williams, RAD., Lambart, PA. & Singleton, P. Pub: Bios Sci.
13. Microbiological Assays. Hewitt.
14. Antiviral Drugs. Kargor, S.
15. Burger's Medicinal chemistry Vol. I – III. Ed. Nanfield E. World.
16. The control of antibiotic resistant bacteria. Stuart, Harris and Harris.
17. Indian Pharmacopea; United States Pharmacopea; British Pharmacopea.

### **Semester - IV Practical Paper- I**

#### **MBP 405: ENVIRONMENTAL MICROBIOLOGY & MEDICAL MICROBIOLOGY**

1. Determination of Biochemical Oxygen Demand (BOD) of sewage water
2. Determination of Chemical Oxygen Demand (COD) of industrial waste water
3. Bacteriological examination of water using multiple tube fermentation test: presumptive test, confirmed test and completed coli form test.
4. Estimation of Gross primary productivity (GPP), Net primary Productivity (NPP), and Respiratory Consumption (RC) to determine the autotrophic/heterotrophic status of aquatic bodies
5. Estimation of phosphates, sulphates and nitrates (eutrophication factors) in polluted and unpolluted water bodies
6. Disinfection of potable water by chlorine (bleaching power method) – determination of chlorine demand and residual chlorine
7. Biomonitoring of water quality by algal indices: Nygaard's index, Palmer's index, Kothe's index, Margalef's index.
8. Bioremediation of heavy metals : chromium/cadmium/lead
9. Phytoremediation of toxic metals by cyanobacterial species
10. Assay of lignolytic enzymes (lignin peroxidase and laccase) by white rot fungi
11. Decolourization of dye effluents by immobilized bacteria and fungi
12. Biodesulphurization of coal by *Thiobacillus ferrooxidans*
13. Air sampling by Petri plate method/gravity slide method/tilak air sampler
14. Estimation of xylanase enzyme : Role in biopulping
15. Preparation of different types of culture media, staining techniques – Gram's staining, F.B. staining, Albert staining, Capsular staining etc.
16. Identification of various pathogenic bacteria by biochemical, enzymatic and serological methods.
17. Bacteriological examination of urine, blood, pus, sputum, stools etc. from patients for diagnosis.
18. Cultivation of viruses.
19. Egg inoculation methods.
20. Tissue culture techniques.
21. Animal inoculation technique.
22. Microscopic studies of virus infected materials.
23. Potency test for vaccines.
24. Toxicity test for vaccines.
25. Handling of lab animals.
26. Examination of pathogenic fungi.
27. Examination of stools for helminthes & Amoeba.
28. Examination of blood smears to identify malarial parasite.
29. Isolation, observation and identification of normal microbial flora of human body.



**MBP 405: ENVIRONMENTAL MICROBIOLOGY & MEDICAL MICROBIOLOGY**  
**Semester - IV                      Question Bank                      Paper - I**

Max. Marks: 100

## 1. Major Experiment 25 Marks

1. Determination of Biochemical Oxygen Demand (BOD) of sewage water
2. Determination of Chemical Oxygen Demand (COD) of industrial waste water
3. Bacteriological examination of water using multiple tube fermentation test: presumptive test, confirmed test and completed coli form test.
4. Estimation of Gross primary productivity (GPP), Net primary Productivity (NPP), and Respiratory Consumption (RC) to determine the autotrophic/heterotrophic status of aquatic bodies
5. Bioremediation of heavy metals : chromium/cadmium/lead
6. Phytoremediation of toxic metals by cyanobacterial species
7. Assay of lignolytic enzymes (lignin peroxidase and laccase) by white rot fungi
8. Air sampling by Petri plate method/gravity slide method/tilak air sampler

## 2. Major Experiment 25 Marks

1. Preparation of different types of culture media, staining techniques – Gram's staining, F.B.staining, Acid fast staining, Albert staining, Capsular staining etc.
2. Bacteriological examination of urine, blood, pus, sputum, stools etc. from patients for diagnosis.
3. Examination of pathogenic fungi.
4. Examination of stools for Helminths & Amoeba.
5. Examination of blood smears to identify malarial parasite.
6. Isolation, observation and identification of normal microbial flora of human body.

### 3. Minor Experiment 10 Marks

1. Estimation of phosphates, sulphates and nitrates (eutrophication factors) in polluted and unpolluted water bodies
2. Disinfection of potable water by chlorine (bleaching power method) – determination of chlorine demand and residual chlorine
3. Biomonitoring of water quality by algal indices: Nygaard's index, Palmer's index, Kothe's index, Margalef's index.
4. Decolourization of dye effluents by immobilized bacteria and fungi
5. Biodesulphurization of coal by *Thiobacillus ferrooxidans*
6. Estimation of xylanase enzyme : Role in biopulping

#### 4. Minor Experiment 10 Marks

1. Animal inoculation technique.
2. Microscopic studies of virus infected materials.
3. Potency test for vaccines.
4. Toxicity test for vaccines.
5. Handling of lab animals.
6. Cultivation of viruses.
7. Egg inoculation methods.

8. Tissue culture technique.
9. Identification of pathogenic bacteria by microscopy and biochemical tests.

## 5. Spotters Identification (4 Nos)

20 Marks

- |                                      |  |
|--------------------------------------|--|
| 1. Multiple tube fermenter           | 20. Candida albicans infection of the tongue |
| 2. Winogradsky column                | 21. Athletes foot                            |
| 3. Aeroflora agar plate              | 22. Black piedra                             |
| 4. Dye effluent treatment            | 23. Ring worm                                |
| 5. Decomposed litter Humus           | 24. <i>Microsporum</i>                       |
| 6. Bioleaching rayon pulp            | 25. Chromomycosis                            |
| 7. Desulphurised coal (Clean coal)   | 26. <i>Madurella mycetomatis</i>             |
| 8. Drug sensitivity                  | 27. Blastomycosis                            |
| 9. TSIA slants                       | 28. <i>Histoplasma capsulatum</i>            |
| 10. Small pox                        | 29. <i>Cryptococcus neoformans</i>           |
| 11. Mumps                            | 30. <i>Plasmodium</i>                        |
| 12. HSV infection                    | 31. Elephantiasis                            |
| 13. Staphylococcal skin Infection    | 32. Leishmaniasis                            |
| 14. Syphilis infection               | 33. $\alpha$ -Haemolytic streptococci plate  |
| 15. Gas gangrene                     | 34. $\beta$ - Haemolytic streptococci plate  |
| 16. <i>Corynebacterium</i> infection | 35. Proteolytic activity                     |
| 17. EMB plate                        | 36. Lipolytic activity                       |
| 18. Measles                          |  |
| 19. Herpes vesicles                  |  |

## 6. Record

10 Marks

### Semester – I V Practical Paper - II

#### MBP 406: MICROBIAL TECHNOLOGY

1. Enumeration of microorganisms from food, feed, vegetable and fruits.
2. Screening of mycotoxins from infected food material
3. Detection of microbial contamination in milk through direct microscopic count (DMC)
4. Detection of microbial contamination through MPN method.
5. Isolation and identification of yeast and formulation of Bakers yeast.
6. Wine production.
7. Methylene blue reductase test for milk quality.
8. Microbial reactions in litmus milk.
9. Assay of cellobiohydrolase.
10. Assay of endogluconase.
11. Production and assay of  $\beta$  - amylase.
12. Production and assay of  $\alpha$  - amylase
13. Production and assay of protease.
14. Production and assay of lipase.
15. Production and assay of asparaginase.
16. Production and assay of Phosphatase.
17. Bio - transformation of organic compounds through MOS.
18. Formulation of Bio - pesticides (*Pseudomonas* and *Trichoderma* powder preparation).
19. Bioassay of antagonism microorganisms.
20. Seed coating of *Rhizobium* bacteria for  $N_2$  fixation.
21. Screening of P- solubilizing microorganisms through plate method.
22. Extraction of bio – polymers.
23. Preparation of immobilized cells and fermentation

24. Isolation and identification of AM spores by wet sieving method.
25. Quantification of mycorrhizal root infection
26. Cultivation of mushrooms.

### Spotters:

- |                                   |                               |
|-----------------------------------|-------------------------------|
| 1. Infected food                  | 12. Idly                      |
| 2. Infected vegetables            | 13. Curd                      |
| 3. Infected fruits                | 14. Alcohol                   |
| 4. Aflatoxin                      | 15. <i>Aspergillus</i>        |
| 5. Mushroom spawn                 | 16. <i>Penicillium</i>        |
| 6. Cropping (Casing)              | 17. <i>Fusarium</i>           |
| 7. Biopesticides                  | 18. <i>Cunninghamella</i>     |
| 8. VAM spores by funnel technique | 19. <i>Alternaria</i>         |
| 9. Baker's yeast.                 | 20. <i>Trichoderma</i> powder |
| 10. Foods Fermented beverages     | 21. Antagonism microorganisms |
| 11. Cheese                        | 22. Immobilized cell          |

## Semester – IV Practical Paper - II MBP 406: PHARMACEUTICAL MICROBIOLOGY

1. Sampling of pharmaceuticals for microbial contamination and load (syrups, suspensions, creams and ointments, ophthalmic preparations)
2. Bioassay of chlormphenicol by plate assay method or turbidometric assay method.
3. Determination of D value, Z value for heat sterilization in pharmaceuticals.
4. Neutralization test – Plaque neutralization, Haeme adsorption test.
5. Determination of antimicrobial activity of a chemical compounds (Phenol, resorcinol, thymol, formaldehyde) to that of phenol under Standardization experimental conditions.
6. Sterility testing methods for pharmaceutical and cosmetic products
7. Tests for disinfectants (Phenol coefficient/RWC)
8. Determination of antibacterial spectrum of drugs/antibiotics
9. Chemical assays for antimicrobial drugs
10. Testing for antibiotic/drug sensitivity/resistance
11. Determination of MIC valued for antimicrobial chemicals
12. Microbiological assays for antibiotics (Liquid tube assay, agar tube assay, agar plate assays)
13. Efficacy testing of preservatives like parabens

### Spotters:

- |                           |  |
|---------------------------|--|
| 1. Syrups                 | 9. Sterility testing                         |
| 2. Creams                 | 10. Tetracycline                             |
| 3. Ointment               | 11. Minimal inhibitory concentration (MIC)   |
| 4. D-value                | 12. Synthetic drugs                          |
| 5. Z-value                | 13. Cosmetic product (any available product) |
| 6. Plaque neutralization  |  |
| 7. Heame adsorption test  |  |
| 8. Antimicrobial activity |  |



**FACULTY OF SCIENCE**  
**M.Sc. MICROBIOLOGY**  
**Practical Examination**  
**Semester - IV Question Bank Paper - II**  
**MBP 406: MICROBIAL TECHNOLOGY**  
**AND**  
**PHARMACEUTICAL MICROBIOLOGY**

**Time: 4 Hrs**

**Max. Marks: 100**

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<b>1. Major Experiment</b>	<b>25 Marks</b>
<b>2. Major Experiment</b>	<b>25 Marks</b>
<b>3. Minor Experiment</b>	<b>10 Marks</b>
<b>4. Minor Experiment</b>	<b>10 Marks</b>
<b>5. Spotters Identification (4 Nos)</b>	<b>20 Marks</b>
<b>6. Record</b>	<b>10 Marks</b>