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ADIKAVI NANNAYA UNIVERSITY

RAJAMAHENDRAVARAM

CBCS / Semester System

(W.e.f. 2016-17 Admitted Batch)

I Semester Syllabus

MICROBIOLOGY

MBT- 101 INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY

TOTAL HOURS: 48

CREDITS: 4

UNIT-I

No. of hours: 12

History and mile stones in microbiology.

Contributions of Anton von Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, Ivanowsky.

Importance and applications of microbiology.

Classification of microorganisms – Haeckel's three Kingdom concept, Whittaker's five kingdom concept, three domain concept of Carl Woese.

Outline classification of bacteria as per the second edition of Bergey's Manual of Systematic Bacteriology.

UNIT – II

No. of hours: 10

General characteristics of Bacteria, Archaea, Mycoplasmas and Cyanobacteria.

Ultra structure of Prokaryotic cell- Variant components and invariant components.

General characteristics of viruses.

Morphology, Structure and replication of TMV and HIV.

UNIT-III

No. of hours: 10

General characteristics and outline classification of Fungi, Algae and Protozoa.

Principles of microscopy - Bright field and Electron microscopy (SEM and TEM).

UNIT-IV

No. of hours: 8

Staining Techniques –Simple and Differential (Gram Staining and Spore Staining).

Sterilization and disinfection techniques - Physical methods – autoclave, hot- air oven, pressure cooker, laminar air flow, filter sterilization, Radiation methods – UV rays, Gamma rays.

Chemical methods – alcohols, aldehydes, fumigants, phenols, halogens and hypochlorites.

UNIT –V

No. of hours: 8

Isolation of Microorganisms from natural habitats.

Pure culture techniques – dilution-plating, Streak-plate, Spread-plate, Pour-Plate and micromanipulator. Enrichment culturing.

Preservation of microbial cultures – subculturing, overlaying cultures with mineral oils, lyophilization, sand cultures, storage at low temperature.

MBP- 101 INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY

TOTAL HOURS: 48

CREDITS: 2

1. Microbiology Good Laboratory Practices and Biosafety.
2. Preparation of culture media for cultivation of bacteria
3. Preparation of culture media for cultivation of fungi
4. Sterilization of medium using Autoclave
5. Sterilization of glassware using Hot Air Oven
6. Light compound microscope and its handling
7. Microscopic observation of bacteria (Gram +ve bacilli and cocci, Gram -ve bacilli), Cyanobacteria, Algae and Fungi.
8. Simple staining
9. Gram's staining
10. Hanging-drop method.
11. Isolation of pure cultures of bacteria by streaking method.
12. Preservation of bacterial cultures by various techniques.
13. Diagrammatic or Electron photomicrographic observation of TMV, HIV, T4 phage and Adenovirus

SUGGESTED READINGS

Alexopoulos, C.J., Mims, C.W. and Blackwell, M. (1996). **Introductory Mycology**, Wiley, New York.

Atlas, R.A. and Bartha, R. (2000). **Microbial Ecology . Fundamentals and Application**, Benjamin Cummings, New York.

Dimmock, N.J., Easton, A.J. and Leppard, K.N. (2001). **Introduction to Modern Virology**, Blackwell Science Ltd, U.K.

Dube, R.C. and Maheswari, D.K. (2000) **General Microbiology**. S Chand, New Delhi. Edition), Himalaya Publishing House, Mumbai.

Frobisher, H., Hinsdil, R.D., Crabtree, K.T. and Goodhart, D.R. (2005). **Fundamentals of Microbiology**, Saunder and Company, London.

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- Niclin, J. et al. (1999). **Instant Notes in Microbiology**. Viva Books Pvt. Ltd., New Delhi.
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- Gopal Reddy et al Laboratory **Experiments in Microbiology**
- Power, C.B. and Dagainawala, H.F. (1986). **General Microbiology** Vol I & II (2nd
- Prescott, M.J., Harley, J.P. and Klein, D.A. (2010). **Microbiology**. 5th Edition, WCB Mc GrawHill, New York.
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- Talaro, K. and Talaro, A. (1996). **Foundations in Microbiology**. 2nd Edition. UMC Brown Publications.
- Webster, J. (1980). **Introduction to Fungi**, Cambridge University Press, Cambridge,
- Wilson, K. and Walker, J. (1994). **Practical Biochemistry**. 4 th Edition, Cambridge University Press, England.
- Zubay, G. (1998). **Biochemistry** WCB. Mc GrawHill, Iowa.

ADIKAVI NANNAYA UNIVERSITY, RAJAMAHENDRAVARAM
CBCS/SEMESTER SYSTEM
B.Sc MICROBIOLOGY (CBCS) SYLLABUS
FOR 2016-17 ADMITTED BATCH

FIRST YEAR – SEMESTER- II

MBT- 201 : MICROBIAL BIOCHEMISTRY & METABOLISM

TOTAL HOURS: 48

CREDITS: 4

UNIT-I

No. of hours: 10

Outline classification and general characteristics of carbohydrates (monosaccharides, disaccharides and polysaccharides).

General characteristics of amino acids and proteins.

Structure of nitrogenous bases, nucleotides, nucleic acids.

Fatty acids (saturated and unsaturated)

lipids (sphingolipids, sterols and phospholipids).

UNIT-II

No. of hours: 8

Principle and applications of -

Colorimetry

Chromatography (paper, thin-layer and affinity chromatography)

Spectrophotometry (UV & visible),

Centrifugation and

UNIT-III

No. of hours: 10

Properties and classification of Enzymes.

Biocatalysis- induced fit and lock and key models.

Role of Coenzymes and Cofactors in enzyme activity.

Factors affecting catalytic activity of enzymes.

Inhibition of enzyme activity- competitive, noncompetitive, uncompetitive and allosteric.

UNIT-IV

No. of hours: 10

Microbial Nutrition –Nutritional requirements and uptake of nutrients by cells.

Nutritional groups of microorganisms- autotrophs, heterotrophs, mixotrophs.

Outlines of oxygenic and anoxygenic photosynthesis in bacteria

Growth media- synthetic, complex, selective, enrichment and differential media.

Microbial Growth- different phases of growth in batch cultures, Synchronous, continuous, biphasic growth.

Factors influencing microbial growth.

Methods for measuring microbial growth – Direct microscopy, viable count estimates, turbidometry and biomass.

UNIT-V

No. of hours: 10

Aerobic respiration -Glycolysis, HMP path way, ED path way, TCA cycle, Electron transport, oxidative and substrate level phosphorylation.
Anaerobic respiration (Nitrate).

Fermentation - Alcohol and lactic acid fermentations.

MBP- 201: MICROBIAL BIOCHEMISTRY & METABOLISM

TOTAL HOURS: 48

CREDITS: 2

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

SUGGESTED READING

Berg JM, Tymoczko JL and Stryer L (2011) **Biochemistry**, W.H.Freeman and Company

Caldwell, D.R. (1995). **Microbial Physiology and Metabolism**, W.C. Brown Publications, Iowa, USA.

Campbell, PN and Smith AD (2011) **Biochemistry** Illustrated, 4th ed., Published by Churchill Livingstone

Elliot, W.H. and Elliot, D.C. (2001). **Biochemistry and Molecular Biology**, 2 nd Edition, Oxford University Press, U.S.A.

Gottschalk, G. (1986). **Bacterial Metabolism**, SpringerVerlag, NewYork.

Lehninger, A.L., Nelson, D.L. and Cox, M.M. (1993). **Principles of Biochemistry**, 2 nd Edition, CBS Publishers and Distributors, New Delhi.

Madigan, M.T., Martinkl, J.M. and Parker, J. (2010). **Brock Biology of Microorganisms**, 9th Edition, MacMillan Press, England.

Moat, A.G. and Foster, J.W. (1995). **Microbial Physiology**, JohnWiley, New York.

Nelson DL and Cox MM (2008) Lehninger **Principles of Biochemistry**, 5th Edition., W.H. Freeman and Company.

Prescott, M.J., Harley, J.P. and Klein, D.A. (2010). **Microbiology**. 5th Edition, WCB Mc GrawHill, New York.

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Sashidhara Rao, B. and Deshpande, V. (2007). **Experimental Biochemistry: A student Companion**. I.K. International Pvt. Ltd.

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Tymoczko JL, Berg JM and Stryer L (2012) **Biochemistry: A short course**, 2nd ed., W.H.Freeman

Voet,D. and Voet J.G (2004) **Biochemistry** 3rd edition, John Wiley and Sons

White, D. (1995). **The Physiology and Biochemistry of Prokaryotes**, Oxford University Press, New York.

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ADIKAVI NANNAYA UNIVERSITY

RAJAMAHENDRAVARAM

CBCS / Semester System

(W.e.f. 2015-16 Admitted Batch)

III Semester Syllabus

MICROBIOLOGY

MBT- 301 MICROBIAL GENETICS AND MOLECULAR BIOLOGY

TOTAL HOURS:48

CREDITS: 4

UNIT-I

No. of hours: 10

DNA and RNA as genetic material.

Structure and organization of prokaryotic DNA.

Extrachromosomal genetic elements – Plasmids and transposons in bacteria.

Replication of DNA – Semi conservative mechanism, Enzymes involved in replication.

UNIT-II

No. of hours: 10

Mutations – spontaneous and induced, base pair changes, frame shifts, deletions, inversions, tandem duplications, insertions.

Mutagens - Physical and Chemical mutagens.

Outlines of DNA damage and repair mechanisms.

Genetic recombination in bacteria – Conjugation, Transformation and Transduction.

UNIT-III

No. of hours: 10

Types of RNA and their functions.

Genetic code.

Structure of ribosomes.

UNIT-IV

No. of hours: 8

Types of genes – structural, constitutive, regulatory

Protein synthesis – Transcription and translation.

Regulation of gene expression in bacteria – *lac* operon.

UNIT-V

No. of hours: 10

Basic principles of genetic engineering.

Restriction endonucleases, DNA polymerases and ligases.

Vectors like Pbr 322, M13.

Outlines of gene cloning methods.

Polymerase chain reaction. Genomic and cDNA libraries.

General account on application of genetic engineering in industry, agriculture and medicine.

MBP- 301 MICROBIAL GENETICS AND MOLECULAR BIOLOGY

TOTAL HOURS: 48

CREDITS: 2

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

SUGGESTED READING

Crueger, W. and Crueger, A. (2000). **Biotechnology: A Text Book of Industrial Microbiology**, PrenticeHall of India Pvt. Ltd., New Delhi.

Freifelder, D. (1990). **Microbial Genetics**. Narosa Publishing House, New Delhi.

Freifelder, D. (1997). **Essentials of Molecular Biology**. Narosa Publishing House, New Delhi.

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Lewin, B. (2000). **Genes VIII**. Oxford University Press, England

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- Nicholl, D.S.T. (2004). **An Introduction to Genetic Engineering**. 2 nd Edition. Cambridge University Press, London.
- Old, R.W. and Primrose, S.B. (1994) **Principles of Gene Manipulation**, Blackwell Science Publication, New York.
- Ram Reddy, S., Venkateswarlu, K. and Krishna Reddy, V. (2007) **A text Book of Molecular Biotechnology**. Himalaya Publishers, Hyderabad.
- Sinnot E.W., L.C. Dunn and T. Dobzhansky. (1958). **Principles of Genetics**. 5 th Edition. McGraw Hill, New York.
- Smith, J.E. (1996). **Biotechnology**, Cambridge University Press.
- Snyder, L. and Champness, W. (1997). **Molecular Genetics of Bacteria**. ASM press,
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- 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.
- Twynan, R.M. (2003). **Advanced Molecular Biology**. Viva books Pvt. Ltd. New Delhi.
- Verma, P.S. and Agarwal, V.K. (2004). **Cell Biology, Genetics, Molecular Biology, Evolution and Ecology**. S. Chand & Co. Ltd., New Delhi.
Washington, D.C., USA.

ADIKAVI NANNAYA UNIVERSITY
CBCS/SEMESTER SYSTEM
IV SEMESTER: B.Sc MICROBIOLOGY

MBT- 401 IMMUNOLOGY AND MEDICAL MICROBIOLOGY

TOTAL HOURS: 48

CREDITS: 4

UNIT-I

No. of hours: 10

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

UNIT-II

No. of hours: 10

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

UNIT-III

No. of hours: 10

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

UNIT-IV

No. of hours: 8

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

General account on microbial diseases – causal organism, pathogenesis, epidemiology, diagnosis, prevention and control

Bacterial diseases – Tuberculosis and Typhoid

Fungal diseases – Candidiasis.

Protozoal diseases – Malaria.

Viral Diseases - Hepatitis- A and AIDS

MBP- 401 IMMUNOLOGY AND MEDICAL MICROBIOLOGY

TOTAL HOURS: 48

CREDITS: 2

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

SUGGESTED READING

Abbas AK, Lichtman AH, Pillai S. (2007). **Cellular and Molecular Immunology**. 6th edition Saunders Publication, Philadelphia.

Ananthanarayan R. and Paniker C.K.J. (2009) **Textbook of Microbiology**. 8th edition, University Press Publication

Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013)

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Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's **Essential Immunology**. 11th edition Wiley-Blackwell Scientific Publication, Oxford.

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edition. McGraw Hill Higher Education

MBT- 401 IMMUNOLOGY AND MEDICAL MICROBIOLOGY

Model Question Paper

Time:3 Hrs

Section –A

Max Marks:75

Answer any Five of the Following 5x10=50

Draw labelled diagrams wherever necessary

1. a. Explain types of immunity?
b. Write notes on cells of immune system and their functions ?
2. a. Write in detail about types of antigens and factors effectinf antigenecity?
b. Write notes on antigen and antibody interactions?
3. a. Discuss in detail about collecton and transport of clinical samples?
b. Write In detail about cultural and biochemical methods of laboratory diagnosis microbial infections?
4. a. Explain in detail about transcription in bacteria?
b. Explain about *Lac operon* model?
5. a. Write in detail about vaccines?
b. Write in detail about mechanism of action of anti bacterial agents?

Section –B

Max Marks:25

Answer any Five of the Following 5x5=25

6. Bonemarrow
7. Macrophage
8. Immunoglobulins
9. Monoclonal antibodies
10. Autoimmunity
11. Normal flora of human body
12. Antiviral agents
13. Disc diffusion method

ADIKAVI NANNAYA UNIVERSITY, RAJAMAHENDRAVARAM
B.Sc MICROBIOLOGY (CBCS) SYLLABUS
THIRD YEAR – SEMESTER- V

MBT- 501 ENVIRONMENTAL & AGRICULTURAL MICROBIOLOGY

TOTAL HOURS: 36

CREDITS: 3

UNIT - I

No. of hours: 8

Terrestrial Environment: Soil profile and soil microflora
 Aquatic Environment: Microflora of fresh water and marine habitats
 Atmosphere: Aeromicroflora and dispersal of microbes

UNIT – II

No. of hours: 8

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

UNIT – III

No. of hours: 6

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

UNIT – IV

No. of hours: 7

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

UNIT – V

No. of hours: 7

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

MBP- 501 ENVIRONMENTAL & AGRICULTURAL MICROBIOLOGY

TOTAL HOURS: 36

CREDITS: 2

1. Preparation of soil extract agar and any one culture media for algal growth
2. Isolation of microbes (bacteria and fungi) from soil.
3. Study of air micro flora by petriplate exposure method.
4. Microbiological Analysis of potable water Standard Plate Count

5. Determination of Dissolved Oxygen (DO) of water samples.
6. Isolation of *Rhizobium* from root nodules.
7. Isolation of actinomycetes on I.S.P. media (International Streptomyces project media)
8. Observation of photo micrographs of plant diseases of local importance - Citrus canker, Tikka disease of Groundnut, Bhandi yellow vein mosaic, Rusts, Smuts, Powdery mildews, Tomato leaf curl.

SUGGESTED READINGS

Atlas RM and Bartha R. (2000). **Microbial Ecology: Fundamentals & Applications**. 4th edition. Benjamin/Cummings Science Publishing, USA

Barton LL & Northup DE (2011). **Microbial Ecology**. 1st edition, Wiley Blackwell, USA

Campbell RE. (1983). **Microbial Ecology**. Blackwell Scientific Publication, Oxford, England.

Coyne MS. (2001). **Soil Microbiology: An Exploratory Approach**. Delmar Thomson Learning.

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Okafor, N (2011). **Environmental Microbiology of Aquatic & Waste systems**. 1st edition, Springer, New York.

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Stolp H. (1988). **Microbial Ecology: Organisms Habitats Activities**. Cambridge University Press, Cambridge, England.

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B.Sc MICROBIOLOGY (CBCS) SYLLABUS
ADIKAVI NANNAYA UNIVERSITY, RAJAMAHENDRAVARAM
THIRD YEAR – SEMESTER -V

MBT- 601: FOOD AND INDUSTRIAL MICROBIOLOGY

TOTAL HOURS: 36

CREDITS: 3

UNIT- I

No. of hours: 8

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

UNIT – II

No. of hours: 7

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

UNIT – III

No. of hours: 6

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

UNIT – IV

No. of hours: 8

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

UNIT – V

No. of hours: 7

Microbial production of Industrial products - Citric acid, Ethanol, amylases, penicillin, glutamic acid and vitamin B12.

MBP- 601 : FOOD AND INDUSTRIAL MICROBIOLOGY

TOTAL HOURS: 36

CREDITS: 2

1. Isolation of bacteria and fungi from spoiled bread/fruits/vegetables
2. Preparation of Yogurt/Dahi

3. Determination of the microbiological quality of milk sample by MBRT
4. Isolation of antagonistic microorganisms by crowded plate technique
5. Design of Fermenter(identification of diagrams of various types of Fermentors and labelling of parts)
6. Microbial fermentation for the production and estimation of ethanol from Grapes.
7. Microbial fermentation for the production and estimation of citric acid.

SUGGESTED READING

Adams MR and Moss MO. (1995). **Food Microbiology**. 4th edition, New Age International (P) Limited Publishers, New Delhi, India.

Banwart JM. (1987). **Basic Food Microbiology**. 1st edition. CBS Publishers and Distributors, Delhi, India.

Casida LE. (1991). **Industrial Microbiology**. 1st edition. Wiley Eastern Limited.

Crueger W and Crueger A. (2000). **Biotechnology: A textbook of Industrial Microbiology**. 2nd Edition. Panima Publishing Company, New Delhi

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Patel AH. (1996). **Industrial Microbiology** .1st Edition. MacMillan India Limited Publishing Company Ltd. New Delhi, India

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Tortora GJ, Funke BR, and Case CL. (2008). **Microbiology: An introduction**. 9th Edition. Pearson Education

Willey JM, Sherwood LM AND Woolverton CJ (2013), Prescott, Harley and Klein's **Microbiology**. 9th Edition. McGraw Hill Higher education

ADIKAVI NANNAYA UNIVERSITY
Structure of MICROBIOLOGY under CBCS
w.e.f. 2015-16 ADMITTED BATCH

<i>Year</i>	<i>Semester</i>	<i>Paper</i>	<i>Title</i>	<i>Hours</i>	<i>Marks</i>	<i>Credits</i>
III	VI	VII (A)	Microbial Biotechnology	3	100	03
			Practical	2	50	02
		** VIII-A	Cluster Elective-A			
			VIII-A-1 : MICROBIAL DIAGNOSIS IN HEALTH CLINICS	3	100	03
			VIII-A-2 : MICROBIAL QUALITY CONTROL IN FOOD AND PHARMACEUTICAL INDUSTRIES	3	100	03
			VIII-A-3: BIOFERTILIZERS AND BIOPESTICIDES	3	100	03
			VIII-A-1 : Practical	2	50	02
VIII-A-2 : Practical	2	50	02			
VIII-A-3: Practical	2	50	02			

ADIKAVI NANNAYA UNIVERSITY
B.Sc MICROBIOLOGY (CBCS) SYLLABUS
THIRD YEAR – SEMESTER- VI

MBT- 701 MICROBIAL BIOTECHNOLOGY

TOTAL HOURS: 36

CREDITS: 3

UNIT- I

No. of Hours: 8

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

UNIT- II

No. of Hours: 7

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

UNIT- III

No. of Hours: 10

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

UNIT- IV

No. of Hours: 7

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

UNIT- V

No. of Hours: 4

Outlines of Intellectual Property Rights: Patents, Copyrights, Trademarks

MBP- 701 MICROBIAL BIOTECHNOLOGY

TOTAL HOURS: 36

CREDITS: 2

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

SUGGESTED READING

Crueger W, Crueger A (1990) **Biotechnology: A text Book of Industrial Microbiology** 2nd edition Sinauer associates, Inc.

Demain, A. L and Davies, J. E. (1999). **Manual of Industrial Microbiology and Biotechnology**, 2nd Edition, ASM Press.

Glazer AN and Nikaïdo H (2007) **Microbial Biotechnology**, 2nd edition, Cambridge University Press

Glick BR, Pasternak JJ, and Patten CL (2010) **Molecular Biotechnology** 4th edition, ASM Press

Gupta PK (2009) **Elements of Biotechnology** 2nd edition, Rastogi Publications

Prescott, Harley and Klein's **Microbiology** by Willey JM, Sherwood LM, Woolverton CJ (2014), 9th edition, Mc Graw Hill Publishers.

Ratledge, C and Kristiansen, B. (2001). **Basic Biotechnology**, 2nd Edition, Cambridge University Press.

Stanbury PF, Whitaker A, Hall SJ (1995) **Principles of Fermentation Technology** 2nd edition., Elsevier Science

Swartz, J. R. (2001). **Advances in Escherichia coli production of therapeutic proteins. Current Opinion in Biotechnology**, 12, 195–201.

ADIKAVINANNAYA UNIVERSITY
B.Sc MICROBIOLOGY (CBCS) SYLLABUS
THIRD YEAR – SEMESTER- VI
CLUSTER PAPERS UNDER ELECTIVE 801 (801A, 801B & 801C)
MBT- 801 A1: MICROBIAL DIAGNOSIS IN HEALTH CLINICS

TOTAL HOURS: 36

CREDITS: 3

UNIT- I
hours: 8

No. of

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

UNIT- II

No. of hours: 8

Collection of clinical samples (oral cavity, throat, skin, blood, CSF, urine and faeces) and precautions required.

Method of transport of clinical samples to laboratory and storage.

UNIT- III

No. of hours: 8

Examination of sample by staining - Gram stain, Ziehl-Neelson staining for tuberculosis, Giemsa-stained thin blood film for malaria

Preparation and use of culture media - Blood agar, Chocolate agar, Lowenstein-Jensen medium, MacConkey agar, Distinct colony properties of various bacterial pathogens.

UNIT- IV

No. of hours: 6

Serological Methods - Agglutination, ELISA, immunofluorescence, Nucleic acid based methods - PCR, Nucleic acid probes.

Typhoid, Dengue and HIV, Swine flu.

UNIT- V

No. of hours: 6

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

MBP- 801 A1: MICROBIAL DIAGNOSIS IN HEALTH

CLINICSTOTAL HOURS: 36

CREDITS: 2

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

SUGGESTED READING

Ananthanarayan R and Paniker CKJ (2009) **Textbook of Microbiology**, 8th edition, Universities Press Private Ltd.

Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's **Medical Microbiology**. 26th edition. McGraw Hill Publication

Collee JG, Fraser, AG, Marmion, BP, Simmons A (2007) Mackie and McCartney Practical **Medical Microbiology**, 14th edition, Elsevier.

Randhawa, VS, Mehta G and Sharma KB (2009) **Practicals and Viva in Medical Microbiology** 2nd edition, Elsevier India Pvt Ltd

Tille P (2013) Bailey's and Scott's **Diagnostic Microbiology**, 13th edition, Mosby

2. Preparation of Yogurt/Dahi
3. Determination of the microbiological quality of milk sample by MBRT
4. Isolation of antagonistic microorganisms by crowded plate technique
5. Design of Fermenter(identification of diagrams of various types of Fermentors and labelling of parts)
6. Microbial fermentation for the production and estimation of ethanol from Grapes.
7. Microbial fermentation for the production and estimation of citric acid.

ADIKAVINANNAYA UNIVERSITY
B.Sc MICROBIOLOGY (CBCS) SYLLABUS
THIRD YEAR – SEMISTER-VI

MBT- 801-A3: BIOFERTILIZERS AND BIOPESTICIDES

TOTAL HOURS: 36

CREDITS: 3

UNIT – I

No of Hours: 10

General account of the microbes used as biofertilizers for various crop plants and their advantages over chemical fertilizers.

Symbiotic N₂ fixers: *Rhizobium* - Isolation, characteristics, types, inoculum production and field application, legume/pulses plants

Frankia from non-legumes and characterization.

Cyanobacteria and *Azolla*, characterization, mass multiplication, Role in rice cultivation, Crop response, field application.

UNIT – II

No of Hours: 6

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

UNIT – III

No of Hours: 6

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

UNIT – IV

No of Hours: 7

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

UNIT – V

No of Hours: 7

General account of microbes used as bioinsecticides and their advantages over synthetic pesticides.

Bacillus thuringiensis - production, Field applications.

Viruses – NPV cultivation and field applications.

MBP- 801-A3: BIOFERTILIZERS AND BIOPESTICIDES

TOTAL HOURS: 36

CREDITS: 2

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

SUGGESTED READINGS

Agarwal SK (2005) **Advanced Environmental Biotechnology**, APH publication.

Kannaiyan, S. (2003). **Bioethnology of Biofertilizers**, CHIPS, Texas.

Mahendra K. Rai (2005). **Hand book of Microbial biofertilizers**, The Haworth Press, Inc. New York.

Reddy, S.M. et. al. (2002). **Bioinoculants for sustainable agriculture and forestry**, Scientific Publishers.

Saleem F and Shakoori AR (2012) **Development of Bioinsecticide**, Lap Lambert Academic Publishing GmbH KG

Subba Rao N.S (1995) **Soil microorganisms and plant growth** Oxford and IBH publishing co. Pvt. Ltd. NewDelhi.

ADIKAVINANNAYA UNIVERSITY
B.Sc MICROBIOLOGY (CBCS) SYLLABUS
THIRD YEAR – SEMESTER-VI

**MBT- 801-A2: MICROBIAL QUALITY CONTROL IN FOOD AND
PHARMACEUTICAL INDUSTRIES**

TOTAL HOURS: 36

CREDITS: 3

UNIT – I

No. of Hours: 8

Good laboratory practices - Good microbiological practices.

Biosafety cabinets – Working of biosafety cabinets, using protective clothing, specification for BSL-1, BSL-2, BSL-3.

Discarding biohazardous waste – Methodology of Disinfection, Autoclaving & Incineration

UNIT – II

No. of Hours: 8

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

UNIT – III

No. of Hours: 8

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

UNIT – IV

No. of Hours: 8

Enrichment culture technique, Detection of specific microorganisms - on XLD agar, *Salmonella Shigella* Agar, Manitol salt agar, EMB agar, McConkey Agar, Saboraud Agar

Ascertaining microbial quality of milk by MBRT, Rapid detection methods of microbiological quality of milk at milk collection centres (COB, 10 min Resazurin assay).

UNIT – V

No. of Hours: 4

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

MBP- 801-A2: MICROBIAL QUALITY CONTROL IN FOOD AND PHARMACEUTICAL INDUSTRIES

TOTAL HOURS: 36

CREDITS: 2

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

SUGGESTED READING

Baird RM, Hodges NA and Denyer SP (2005) Handbook of Microbiological Quality control in Pharmaceutical and Medical Devices, Taylor and Francis Inc.

Garg N, Garg KL and Mukerji KG (2010) Laboratory Manual of Food Microbiology I K International Publishing House Pvt. Ltd.

Harrigan WF (1998) Laboratory Methods in Food Microbiology, 3rd ed. Academic Press

Jay JM, Loessner MJ, Golden DA (2005) Modern Food Microbiology, 7th edition. Springer

Laboratory Exercises in Microbiology, George.A.Wistreich & Max.D.Lechtman, 3 rd Ed, Glencoe press, London.

Manual of diagnostic microbiology, Dr.B.J.Wadher & Dr.G.L.Bhoosreddy, Firs.Ed., Himalaya publishing house, Nagpur.

Microbiology - A laboratory manual, Cappuccino & Sherman , 6 th Ed, Pearson Education

Pharmaceutical Microbiology – Purohit

Pharmaceutical Microbiology – W.B. Hugo

ADIKAVINANNAYA UNIVERSITY
B.Sc MICROBIOLOGY (CBCS) SYLLABUS
THIRD YEAR – SEMESTER- VI

MBT- 701 MICROBIAL BIOTECHNOLOGY

Model Question Paper

Time: 3Hrs Section – A Max.Marks:75

ANSWER ANY FIVE OF THE FOLLOWING

5 x 10=50 marks

Draw labeled diagrams wherever necessary

- 1.a) Discuss applications of microbial biotechnology?
(or)
b) Industrial applications of genetically engineered microbes?
- 2 a) Write production process of recombinant Hepatitis B vaccine?
(or)
b) Explain production process and applications of microbial polysaccharides and bioplastics?
3. a) Describe immobilization methods and applications?
(or)
b) Explain microbial based transformation of steroids?
4. a) Explain in bio-diesel production ?
(or)
b) Bioremediation of toxic substances?
5. a) Out lines of intellectual property rights for patenting?
(or)
b) Out lines of intellectual property rights for copyrights and trademarks?

Section B 5x5=25

Answer any five of the following

2. Biofertilizer
3. Streptokinase
4. Biosensors
5. Whole cell immobilization
6. Xenobiotics
7. Patents
8. Bio ethanol
9. Bioplastics

ADIKAVINANNAYA UNIVERSITY
B.Sc MICROBIOLOGY (CBCS) SYLLABUS
THIRD YEAR – SEMESTER- VI
CLUSTER PAPER -801A

MBT- 801 A1: MICROBIAL DIAGNOSTICS AND HEALTH CLINICS

Model Question Paper

Time: 3Hrs Section – A Max.Marks:75

ANSWER ANY FIVE OF THE FOLLOWING

5 x 10=50 marks

Draw labeled diagrams wherever necessary

- 1.a) What is tuberculosis? Describe the characters of the causal agent and discuss the pathogenesis of the disease? (or)
- b) Describe the causal agent, laboratory diagnosis, and prevention and treatment of influenza?
- 2 a) Describe the various methods used to collect samples? (or)
- b) Describe various methods of transport of clinical samples to laboratory and storage?
3. a) Write Grams staining and Giemsa-staining techniques for examination of clinical samples? (or)
- b) Write composition and preparation of culture media for identification of pathogens?
4. a) Explain serological methods for identification of pathogens ? (or)
- b) Describe the causal agent, laboratory diagnosis, and prevention and treatment of typhoid?
5. a) How the tests for antimicrobial drug susceptibility are beneficial / Describe serial dilution method? (or)
- b) Give a concise account of disk diffusion tests for antimicrobial drug susceptibility?

Section B 5x5=25

Answer any five of the following

1. Aspergillosis
2. Malaria
3. Transport media
4. Ziehl-Neelson staining
5. Lowenstein-Jensen media
6. ELISA
7. Dengue
8. MIC

ADIKAVINANNAYA UNIVERSITY
B.Sc MICROBIOLOGY (CBCS) SYLLABUS
THIRD YEAR – SEMESTER- VI
CLUSTER PAPER -801 A2

**MBT- 801 A2: MICROBIAL QUALITY CONTROL IN FOOD AND PHARMACUTICAL
INDUSTRIES**

Model Question Paper

Time: 3Hrs Section – A Max.Marks:75

ANSWER ANY FIVE OF THE FOLLOWING

5 x 10=50 marks

Draw labeled diagrams wherever necessary

1. a) Discuss Biosafety in microbiology and biomedical laboratories?
(or)
b) How to discard biohazardous waste?
- 2 a) Describe the various culture and microscopic methods to enumerate the microorganisms? (or)
b) Write Biochemical methods for endotoxin and sterility tests for pharmaceutical products?
3. a) What are nucleic acid probes and what are they used for?
(or)
b) Define PCR? Write methodology for detection and diagnosis of infectious diseases?
4. a) Write enrichment culture techniques??
(or)
b) Discuss rapid detection methods of microbiological quality of milk?
5. a) Discuss various Hazard analysis of critical control points(HACCP)?
(or)
b) Write BIs standards for drinking water?

Section B 5x5=25

Answer any five of the following

6. Incineration
7. Gel diffusion
8. Biosensors
9. Saborauds agar
10. MBRT
11. EMB agar
12. HACCP
13. McCokey agar

ADIKAVINANNAYA UNIVERSITY
B.Sc MICROBIOLOGY (CBCS) SYLLABUS
THIRD YEAR – SEMESTER- VI
CLUSTER PAPER -801C

MBT- 801 A3: BIOFERTILIZERS AND BIOPESTICIDES

Model Question Paper

Time: 3Hrs Section – A Max.Marks:75

ANSWER ANY FIVE OF THE FOLLOWING

5 x 10=50 marks

Draw labeled diagrams wherever necessary

1.a) Write an account on microbes used as biofertilizers for various crops and their advantages over chemical fertilizers? (or)

b) Describe mass multiplication of cyanobacteria and field application in rice cultivation?

2 a) Explain Isolation mass multiplication of *Azospirillum* and field application? (or)

b) Describe isolation, mass multiplication field application of *Azotobacter*?

3. a) Describe isolation, mass multiplication field application of phosphate solubilizing microbes? (or)

b) List out various phosphate solubilizing microbes and its importance?

4. a) Explain various types of mycorrhizae? (or)

b) Mass production of VAM and field applications?

5. a) Discuss *Bacillus thuringiensis* production and field applications? (or)

b) How NPV cultivated and its applications in field?

Section B 5x5=25

Answer any five of the following

6. Rhizobium

7. Frankia

8. Azolla

9. Bioinsecticides

10. Ectomycorrhizae

11. Biofertilizers

12. Sedarophores

13 Cyanobacteria