

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

**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**, 2<sup>nd</sup> edition, Cambridge University Press

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

Gupta PK (2009) **Elements of Biotechnology** 2<sup>nd</sup> 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.

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**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**. 26<sup>th</sup> edition. McGraw Hill Publication

Collee JG, Fraser, AG, Marmion, BP, Simmons A (2007) Mackie and McCartney Practical **Medical Microbiology**, 14<sup>th</sup> 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**, 13<sup>th</sup> 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.

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**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 N<sub>2</sub> 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.

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**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

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**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

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**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

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**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

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**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**