


**B.Sc MICROBIOLOGY (CBCS) REVISED SYLLABUS – 2021**  
**CBCS PATTERN FOR MICROBIOLOGY**

	<b>Government College (Autonomous) Rajahmundry</b>	<b>Program &amp; Semester</b> I B.Sc. MZC, FMZC (I Semester)			
Course Code MBY-140	<b>TITLE OF THE COURSE</b> <b><u>INTRODUCTION TO MICROBIOLOGY</u></b> <b><u>AND MICROBIAL DIVERSITY</u></b>				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites	Introductory microbiology	3	1	-	3

**Paper I: MBY – 140:**

**Course Objectives:**

1. To understand History & Development of Microbiology, Microscopy, staining and sterilization techniques, Ultra-structure of cell, Different methods of microbial characterization
2. To study virology concepts

**Course Outcomes:**

On Completion of the course, the students will be able to-	
CO1	Explain relationship and apply appropriate terminology relating to the structure, Genetics, metabolism and ecology of prokaryotic microorganisms, Algae, viruses and Fungi.
CO2	Students will get basics and importance of Microbiology.
CO3	Demonstrate appropriate laboratory skill and techniques related to microbiology

<b>Skill Development</b> Basic Microbiology lab techniques Practicals Study projects Case	<b>UNIT-IV &amp; V</b>	<b>Employability-</b> Microbiology labs, Clinical labs, MLT, Food Industries	<b>UNIT-IV&amp;V</b>
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**TOTAL HOURS: 60**

**CREDITS: 4**

**UNIT-I: History of Microbiology & Place of Microorganisms in the living world**

**No. of hours: 12**

History of Microbiology- Theory of spontaneous generation-Biogenesis and abiogenesis; in the context of contributions of Anton von Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, Ivanowsky, Martinus Beijerinck and Sergei Winogradsky

Importance and applications of microbiology

Place of Microorganisms in the Living World – Haeckel’s three Kingdom concept, Whittaker’s five kingdom concept, three domain concept of Carl Woese

**UNIT-II: Prokaryotic microorganisms and Viruses****No. of hours: 12**

Ultra structure of Prokaryotic cell- cell wall (in detail); Structure and/Functions (in brief) of cell membrane, cytoplasm, nucleoid, plasmid, inclusion bodies, flagella (brief structure and arrangement), pili, capsule, endospore

General characteristics of Bacteria (Size, shape, arrangement, reproduction) : heterotrophic, autotrophic, parasitic, obligate intracellular parasitic bacteria. General characteristics of Archaea  
General characteristics of viruses, Cultivation of Viruses (in brief)

Morphology, Structure and replication of TMV and Lambda

**UNIT-III: Eukaryotic microorganisms****No. of hours: 12**

Fungi - Habitat, nutrition, vegetative structure and modes of reproduction; outline classification  
Algae - Habitat, thallus organization, photosynthetic pigments, storage forms of food, reproduction.

Protozoa – Habitat, cell structure, nutrition, locomotion, excretion, reproduction, encystment, outline classification

**UNIT-IV: Principles of Microscopy, Sterilization and Disinfection****No. of hours: 12**

Principles of microscopy – Compound (Bright field, Dark field, Phase contrast, Fluorescence) and Electron microscopy (SEM and TEM).

Staining Techniques - Simple and Differential staining techniques (Gram staining, spore staining, Acid fast 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: Isolation pure Culture of Bacteria****No. of hours: 12**

Isolation of Microorganisms from natural habitats.

Pure culture techniques: dilution-plate, Streak-plate, Spread-plate, Pour-Plate and micromanipulator.

Preservation of microbial cultures: sub culturing, overlaying cultures with mineral oils, lyophilization, sand cultures, and storage at low temperature.

**SUGGESTED READING:**

- Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (1993). Microbiology. 5th Edition, Tata Mc Graw Hill Publishing Co., Ltd., New Delhi.
- Dube, R.C. and Maheswari, D.K. (2000) General Microbiology. S Chand, New Delhi. Edition), Himalaya Publishing House, Mumbai.
- Power, C.B. and Dagainawala, H.F. (1986). General Microbiology Vol I & II

- Prescott, M.J., Harley, J.P. and Klein, D.A. (2012). Microbiology. 5th Edition, WCB Mc GrawHill, New York.
- Reddy, S.M. and Reddy, S.R. (1998). Microbiology □ Practical Manual, 3 rd Edition, Sri Padmavathi Publications, Hyderabad.
- Singh, R.P. (2007). General Microbiology. Kalyani Publishers, New Delhi.
- Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. (1991). General Microbiology, 5th Ed., Prentice Hall of India Pvt. Ltd., New Delhi.
- Microbiology Edited by Prescott

**MBY-140: INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY**

**Paper: I SEMESTER –I TIME: 2 1/2 HOURS**

**Maximum Marks: 50**

Section		Unit-I	Unit-II	Unit-III	Unit-IV	Unit-V	Total questions	No of questions answered	Marks allotted
<b>A</b>	Essay Questions	2	2	2	1	1	8	4	10x4 = 40
<b>B</b>	Short questions	2	2	2	2	2	10	5	2X5=10

**Section- A**

**Answer any FIVE question**

**4×10=40 Marks**

1. a) Essay question from unit I.  
(or)  
b). Essay question from unit I
2. a) Essay question from unit II  
Or  
b) Essay question from unit II
3. a) Essay question from unit III  
(or)  
b). Essay question from unit III
4. a) Essay question from unit IV  
(or)  
b). Essay question from unit V

**Section-B**

**Answer any FIVE questions only**

**5×2=10Marks**

- 5.Short question from unit I
- 6.Short question from unit I
- 7.Short question from unit II
- 8.Short question from unit II
- 9.Short question from unit III
- 10.Short question from unit III
- 11.Short question from unit IV
- 12.Short question from unit IV
- 13.Short question from unit V
- 14.Short question from unit V

**Microbiology Model Question Paper (Theory)**

**MBY-140: INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY**

**Paper: I SEMESTER –I**

**Time: 2 1/2Hrs**

**Max.Marks:50**

**Part-A**

**Note: Answer ALL questions**

**4x10 = 40M**

1. a) Explain theory of spontaneous generation, Biogenesis and Abiogenesis.

**OR**

b) explain contribution of martinus beijerinck and Ivanowsky.

2. a) Write about general characteristics of Archea.

**OR**

b) Explain cultivation of viruses.

3. a) Write a short note on nutrition, structure and outline classification of fungi.

**OR**

b) Write a short note on nutrition, structure and outline classification of algae.

4. a) Write principal and procedure of Acid fast staining.

**OR**

b) Explain the methods of preservation of microbial cultures.

**Part-B**

**Answer any five questions. All carry equal marks.**

5. Anton von leeuwenhoek.

10. Locomotion in protozoa.

6. Whittaker 5 Kingdom classification.

11. Gram staining.

7. TMV.

12. Phenols

8. Endospore.

13. Streak plate method

9. Reproduction in fungi.

14. Micromanipulator

**Additional input:**

- Economic importance of Algae
- Economic importance of Fungi
- Calibrations of microscopic measurements (Ocular, stage micrometers)- bacteria

**ASSIGNMENT QUESTIONS**

1. Explain brief history of Microbiology
2. General characteristics of bacteria, virus, fungi, algae, protozoa.
3. Principles of Bright field & electron Microscopy.
4. Principle procedure of Gram staining, spore staining, Acid fast staining
5. Explain Pure culture techniques.
6. Explain methods of Preservation of microbial cultures.

**Web links**


<https://ccelms.ap.gov.in/rusa/user/gtitles/122>

<https://youtube.com/channel/UCAXheRahnkShRUKSRbbihuQ>

**CO-PO Mapping**

**(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], '-' : No correlation)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	2	3	3	3	1	2	2	3	3	3	3
CO2	3	2	3	3	2	3	3	1	3	3	3	2	3
CO3	3	3	3	3	2	2	2	2	2	3	3	2	2
CO4	3	2	2	2	2	2	3	3	1	1	2	2	2
Avg.	2.75	2.5	2.5	2.75	2.25	2.5	2.25	2	2	2.5	2.75	2.25	2.5

	<b>Government College (Autonomous) Rajahmundry</b>	<b>Program &amp; Semester</b>			
Course Code MBY 420P	<b>TITLE OF THE COURSE</b>  <b><u>INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY</u></b>	I B.Sc. MZC & FMZC (I Semester)			
Teaching	Hours Allocated: 30 ( <b>Practical</b> )	L	T	P	C
Pre-requisites	Basic Microbiology	-	-	2	2

### Course Objectives:

1. Introduction to basic microbiology laboratory practices.
2. Usage of different lab equipment and glassware.
3. To learn Sterilization of glassware, Media, equipment.
4. To learn Staining, Microscopy, culturing of microbes.

### Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Understand the basic microbiology laboratory practices
CO2	Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
CO3	Student will gain skills in Sterilization of glassware, Media, equipment.
CO4	Student will gain skills in Staining, Microscopy, culturing of microbes

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. Physical methods - autoclave, hot-air oven, pressure cooker, laminar air flow, filter sterilization.
5. Light compound microscope and its handling
6. Simple staining
7. Gram's staining
8. Hanging-drop method.
9. Isolation of pure cultures of bacteria by serial dilution and streak/spread/pour plate method.
10. Electron micrographic study of viruses-TMV, HIV, Bacteriophages

11. Observation of electron micrographs of bacterial cells/ Microscopic observation of cyanobacteria (*Nostoc*, *Spirulina*), algae (*Scenedesmus* sp Diatoms) and fungi (*Saccharomyces*, *Rhizopus*, *Aspergillus*, *Penicillium*, *Fusarium*).

#### **REFERENCE BOOKS FOR LAB:**

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

#### **Web links**

<https://vlab.amrita.edu/?sub=3&brch=73>

<https://learn.chm.msu.edu/vibl/>

<https://www.labster.com/microbiology-virtual-labs/>

<https://www.scienceprofonline.org/vmc/microbiology-laboratory-course-teaching-materials.html>


<https://virtuallabs.nmsu.edu/>

<https://www.merlot.org/merlot/viewMaterial.htm?id=79694>

## CO-PO Mapping

(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], '-': No correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	2	3	3	3	1	2	2	3	3	3	3
CO2	3	2	3	3	2	3	3	1	3	3	3	2	3
CO3	3	3	3	3	2	2	2	2	2	3	3	2	2
CO4	3	2	2	2	2	2	3	3	1	1	2	2	2
Avg.	2.75	2.5	2.5	2.75	2.25	2.5	2.25	2	2	2.5	2.75	2.25	2.5

	<b>Government College (Autonomous) Rajahmundry</b>	<b>Program &amp; Semester</b> I B.Sc. MZC, FMZC (II Semester)			
Course Code MBY-141	<b>TITLE OF THE COURSE</b> <b>MICROBIAL BIOCHEMISTRY AND METABOLISM</b>				
Teaching	Hours Allocated: 60 ( <b>Theory</b> )	L	T	P	C
Pre-requisites	Knowledge on basics of organic chemistry & metabolic pathways	3	1	-	3

**Course Objectives:**

1. To understand structure of Biomolecules – Carbohydrates, proteins, DNA, RNA, Fats & Lipids
2. Basic properties of enzymes, classification, cofactors, coenzymes, factors affecting activity, inhibition.
3. Instrumentation
4. Microbial nutrition & metabolism

**Course Outcomes:**

On Completion of the course, the students will be able to-	
CO1	1. This Course provides Understanding of biomolecular synthesis and control will help in further study
CO2	1. Develop knowledge on microbial nutrition & microbial metabolism

Skill Development- Analytical techniques Practicals Study projects	<b>UNIT-III</b>
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**UNIT-I: Biomolecules**

**No. of hours: 12**

General characters and outline classification of Carbohydrates (Monosaccharides-Glucose, fructose, ribose, Disaccharides- Sucrose, Lactose, Polysaccharides- Starch, glycogen, Cellulose)  
General characters and outline classification of Lipids and fatty acids (phospholipids, polyβ hydroxy alkanes)  
General characteristics of amino acids and proteins. Amino acids in peptidoglycan  
Structure of Nucleic acid

**UNIT-II: Enzymes**

**No. of hours: 12**

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

Factors effecting enzyme activity

**UNIT – III: Analytical Techniques**

**No. of hours: 12**

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

**UNIT – IV: Microbial Nutrition and growth**

**No. of hours: 12**

Nutritional requirements of Microorganisms and Methods of uptake of nutrients by cell  
Nutritional groups of microorganisms- autotrophs, heterotrophs, lithotrophs, organotrophs, phototrophs, chemotrophs  
Growth media- Natural, synthetic and semi synthetic media, Basal and complex media, selective, enrichment, enriched 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: Microbial metabolism**

**No. of hours: 12**

Aerobic respiration - Glycolysis, TCA cycle, ED Pathway, Electron transport  
Oxidative and substrate level phosphorylations.  
Anaerobic respiration (Nitrate and sulphate respiration)  
Fermentation- lactic acid and ethanol fermentations  
Outlines of oxygenic and anoxygenic photosynthesis in bacteria

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

**Paper II: MBY 141: MICROBIAL BIOCHEMISTRY AND METABOLISM**

**Paper: I SEMESTER –II**

TIME: 2 1/2 HOURS

Maximum Marks: 50

Section		Unit-I	Unit-II	Unit-III	Unit-IV	Unit-V	Total questions	No of questions answered	Marks allotted
<b>A</b>	Essay Questions	2	2	2	1	1	8	4	10×4 = 40
<b>B</b>	Short questions	2	2	2	2	2	10	5	5×2=10

**Section- A**

**Answer any FIVE question**

**4×10=40 Marks**

1. a) Essay question from unit I.  
(or)  
b). Essay question from unit I
2. a) Essay question from unit II  
Or  
b) Essay question from unit II
3. a) Essay question from unit III  
(or)  
b). Essay question from unit III
4. a) Essay question from unit IV  
(or)  
b). Essay question from unit V

**Section-B**

**Answer any FIVE questions only**

**5×2=10Marks**

- 5.Short question from unit I
- 6.Short question from unit I
- 7.Short question from unit II
- 8.Short question from unit II
- 9.Short question from unit III
- 10.Short question from unit III
- 11.Short question from unit IV
- 12.Short question from unit IV
- 13.Short question from unit V
- 14.Short question from unit V

**Microbiology Model Question Paper (Theory)**

**MBY-140: MICROBIAL BIOCHEMISTRY AND METABOLISM**

**Paper: I SEMESTER –II**

**Time: 2 1/2Hrs**

**Max.Marks:50**

**Part-A**

**Note: Answer ALL questions**

**4x10 = 40M**

1. a) Explain about structure and general characteristics of amino acids.

OR

b) Explain structure and function of nucleic acids.

2. a) Explain classification of enzymes with examples.

OR

b) Explain competitive, non-competitive, and uncompetitive inhibition of enzymes.

3. a) Explain principle, procedure and uses of thin layer chromatography.

OR

b) Explain the use of centrifugation and different types of centrifuges.

4. a) Write a note on methods for measuring microbial growth.

OR

b) Give outlines of oxygenic and Anoxygenic photosynthesis in bacteria

**Part-B**

**Answer any five questions. All carry equal marks.**

5. Disaccharides

10. Gel Electrophoresis

6. Fatty acids

11. Bacterial growth curve

7. Lock and key model

12. Selective media

8. Allosteric enzymes

13. Glycolysis

9. Calorimetry

14. Ethanol fermentation

### Additional inputs

Ph meter

Economic importance of enzymes

Examples of fermented products

### Assignment questions

1. General characteristics of carbohydrates, proteins.
2. Structure & properties of nucleic acids, fatty acids.
3. Explain principle procedure of paper chromatography & TLC
4. Explain classification & properties of enzymes.
5. Describe bacterial growth curve & factors affecting bacterial growth.
6. Explain Glycolysis, TCA cycle.

### Web links

<https://ccelms.ap.gov.in/rusa/user/gtitles/122>

<https://www.scienceprofonline.com/virtual-micro-main.html>

<https://slidetodoc.com/history-of-microbiology-from-the-virtual-microbiology-classroom/>


<https://studylib.net/doc/5795921/microbial-growth-lecture-powerpoint>

<https://youtube.com/channel/UCAXheRahnkShRUKSRbbihuQ>

### CO-PO Mapping

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CO2	3	2	3	3	2	3	3	1	3	3	3	2	3
CO3	3	3	3	3	2	2	2	2	2	3	3	2	2
CO4	3	2	2	2	2	2	3	3	1	1	2	2	2
Avg.	2.75	2.5	2.5	2.75	2.25	2.5	2.25	2	2	2.5	2.75	2.25	2.5

	<b>Government College (Autonomous) Rajahmundry</b>	<b>Program &amp; Semester</b>			
Course Code MBY 421P	<b>TITLE OF THE COURSE</b>  <b><u>MBP – II: MICROBIAL PHYSIOLOGY AND BIOCHEMISTRY</u></b>	I B.Sc. MZC & FMZC (II Semester)			
Teaching	Hours Allocated: 30 ( <b>Practical</b> )	L	T	P	C
Pre-requisites	Basic Microbiology	-	-	2	2

### Course Objectives:

1. Introduction to Qualitative analysis.
2. Usage of different lab equipment.
3. To learn chromatographic, colorimetry.
4. Bacterial growth curve

### Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Understand Qualitative analysis
CO2	Student will learn chromatography, colorimetry
CO3	Student will learn about Bacterial growth curve.

1. Qualitative Analysis of Carbohydrates.
2. Qualitative Analysis of Amino acids.
3. Colorimetric estimation of proteins by Biuret / Lowry method.
4. Separation of components of a given mixture using a laboratory scale centrifuge.
5. Separation of mixtures by paper / thin layer chromatography.
6. Demonstration of column packing in any form of column chromatography.
7. Effect of temperature / pH on bacterial growth
8. Demonstration of electrophoretic technique

9. Study and plot the growth curve of E. coli by Turbidometry and standard plate count methods

### LAB MANUALS

- Sashidhara Rao, B. and Deshpande, V. (2007). Experimental Biochemistry: A student Companion. I.K. International Pvt. Ltd.
- Jaya Babu (2006). Practical Manual on Microbial Metabolisms and General Microbiology. Kalyani Publishers, New Delhi.
- Gopal Reddy *et al.*, Laboratory Experiments in Microbiology

### Web links

<https://vlab.amrita.edu/?sub=3&brch=73>

<https://learn.chm.msu.edu/vibl/>

<https://www.labster.com/microbiology-virtual-labs/>

<https://www.scienceprofonline.org/vmc/microbiology-laboratory-course-teaching-materials.html>


<https://virtuallabs.nmsu.edu/>

<https://www.merlot.org/merlot/viewMaterial.htm?id=79694>

### CO-PO Mapping

(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], '-': No correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	2	3	3	3	1	2	2	3	3	3	3
CO2	3	2	3	3	2	3	3	1	3	3	3	2	3
CO3	3	3	3	3	2	2	2	2	2	3	3	2	2
CO4	3	2	2	2	2	2	3	3	1	1	2	2	2
Avg.	2.75	2.5	2.5	2.75	2.25	2.5	2.25	2	2	2.5	2.75	2.25	2.5

	<b>Government College (Autonomous) Rajahmundry</b>	<b>Program &amp; Semester</b> II B.Sc. MZC, FMZC (III Semester)			
Course Code MBY-142	<b>TITLE OF THE COURSE</b> <b>MOLECULAR BIOLOGY AND MICROBIAL GENETICS</b>				
Teaching	Hours Allocated: 60 ( <b>Theory</b> )	L	T	P	C
Pre-requisites	Knowledge on basics of organic chemistry & metabolic pathways	3	1	-	3

**Course Objectives:**

1. To understand DNA, RNA, structure and Replication.
2. Gene expression & regulation
3. DNA damage, mutations and repair. Gene transfer methods.
4. Genetic engineering

**Course Outcomes:**

<b>On Completion of the course, the students will be able to-</b>	
<b>CO1</b>	<b>1. This Course provides Understanding of molecular biology</b>
<b>CO2</b>	<b>2. Develop knowledge on genetic engineering</b>

**UNIT- I: Nucleic acids**

**No. of hours: 12**

DNA and RNA: Role in heredity-The central dogma  
Watson and Crick model of DNA  
Types of RNA: structure and functions  
Organization of DNA in prokaryotes

**UNIT- II : Genetic material and replication**

**No. of hours: 12**

Experiments which established DNA as genetic material, RNA as genetic material  
Mechanism of DNA Replication in Prokaryotes  
Proof of semi conservative mechanism of replication (Messelson – Stahl Experiment)  
Extra chromosomal genetic elements – Plasmids and transposons

**UNIT- III: Gene expression and regulation**

**No. of hours: 12**

Concept of gene – Mutton, recon and cistron; One gene- one polypeptide, one gene- one enzyme and one gene-one product hypothesis.  
Genetic code  
Structure of ribosomes  
Protein synthesis – Transcription and translation in Prokaryotes  
Regulation of gene expression in bacteria – *lac* operon

**UNIT- IV: Mutations, damage and repair**

**No. of hours: 12**

Outlines of DNA damage and repair mechanisms  
Mutations – spontaneous and induced, base pair changes, frame shifts, deletions, inversions,

tandem duplications, insertions

Mutagens – Physical and Chemical mutagens

Bacterial recombination – Transformation, Conjugation, Transduction (Generalized and specialized transductions)

**UNIT- V: Genetic engineering**

**No. of hours: 12**

Basic principles of genetic engineering: Restriction endonucleases, DNA polymerases and ligases. Vectors.

Outlines of gene cloning methods.

Polymerase chain reaction.

Genomic and cDNA libraries.

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

**SUGGESTED READING:**

- Freifelder, D. (1990). Microbial Genetics. Narosa Publishing House, New Delhi.
- Freifelder, D. (1997). Essentials of Molecular Biology. Narosa Publishing House, New Delhi.
- Glick, B.P. and Pasternack, J. (1998). Molecular Biotechnology, ASM Press, Washington D.C., USA.
- Lewin, B. (2000). Genes VIII. Oxford University Press, England.
- Maloy, S.R., Cronan, J.E. and Freifelder, D. (1994). Microbial Genetics, Jones and Bartlett Publishers, London.
- Ram Reddy, S., Venkateshwarlu, 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,
- Strickberger, M.W. (1967). Genetics. Oxford & IBH, New Delhi.

### Paper III: MICROBIAL GENETICS AND MOLECULAR BIOLOGY

Section		Unit-I	Unit-II	Unit-III	Unit-IV	Unit-V	Total questions	No of questions answered	Marks allotted
A	Essay Questions	2	2	2	1	1	8	4	10x4 = 40
B	Short questions	2	2	2	2	2	10	5	2X5=10

#### Microbiology Model Question Paper (Theory)

TIME: 2 1/2 HOURS

Maximum Marks: 50

#### Section- A

Answer any FIVE question

4×10=40 Marks

1. a) Essay question from unit I.  
(or)  
b). Essay question from unit I
2. a) Essay question from unit II  
Or  
b) Essay question from unit II
3. a) Essay question from unit III  
(or)  
b). Essay question from unit III
4. a) Essay question from unit IV  
(or)  
b). Essay question from unit V

#### Section-B

Answer any FIVE questions only

5×2=10Marks

- 5.Short question from unit I
- 6.Short question from unit I
- 7.Short question from unit II
- 8.Short question from unit II
- 9.Short question from unit III
- 10.Short question from unit III
- 11.Short question from unit IV
- 12.Short question from unit IV
- 13.Short question from unit V

**Microbiology Model Question Paper (Theory)**

**MBY-140: MOLECULAR BIOLOGY AND MICROBIAL GENETICS**

**Paper: I SEMESTER –III**

**Time: 2 1/2Hrs**

**Max.Marks:50**

**Part-A**

**Note: Answer ALL questions**

**4x10 = 40M**

1. a) Explain Watson and crick model of DNA along with labelled diagram.

**OR**

b) Write a note on organisation of DNA in prokaryotes.

2. a) Write about experimental proof of DNA as genetic material.

**OR**

b) Explain DNA replication in prokaryotes with labelled diagram

3. a) Explain protein synthesis in prokaryotes with labelled diagram.

**OR**

b) Write a note on lack operon.

4. a) Define mutations and explain different types of mutations.

**OR**

b) Describe outlines of gene cloning methods.

**Part-B**

**Answer any five questions. All carry equal marks.**

5. Central dogma

10. Muton, Recon and Cistron

6. Types of RNA

11. Conjugation

7. Plasmids

12. Transduction

8. Transposons

13. Restriction endonucleases

9. Genetic code

14. PCR

### **Additional inputs**

AMES TEST

GMOS

RTPCR

### **Assignment questions**

Watson & Crick model of DNA

Replication

Transcription

Translation

Genetic Code

Mutations

Outlines Of Gene Cloning

### **Web links**

<https://ccelms.ap.gov.in/rusa/user/gtitles/122>

<https://www.scienceprofonline.com/virtual-micro-main.html>

<https://slidetodoc.com/history-of-microbiology-from-the-virtual-microbiology-classroom/>

<https://studylib.net/doc/5795921/microbial-growth-lecture-powerpoint>


<https://youtube.com/channel/UCAXheRahnkShRUKSRbbihuQ>

### **CO-PO Mapping**

(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], '-' : No correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	2	3	3	3	1	2	2	3	3	3	3
CO2	3	2	3	3	2	3	3	1	3	3	3	2	3
CO3	3	3	3	3	2	2	2	2	2	3	3	2	2
CO4	3	2	2	2	2	2	3	3	1	1	2	2	2
Avg.	2.75	2.5	2.5	2.75	2.25	2.5	2.25	2	2	2.5	2.75	2.25	2.5

### MBP – III: MOLECULAR BIOLOGY AND MICROBIAL GENETICS

	<b>Government College (Autonomous) Rajahmundry</b>	<b>Program &amp; Semester</b>			
Course Code MBY 421P	<b>TITLE OF THE COURSE</b>  <b><u>MBP – II: MICROBIAL PHYSIOLOGY AND BIOCHEMISTRY</u></b>	I B.Sc. MZC & FMZC (II Semester)			
Teaching	Hours Allocated: 30 ( <b>Practical</b> )	L	T	P	C
Pre-requisites	Basic Microbiology	-	-	2	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

#### **REFERENCE BOOKS FOR LAB:**

- Wilson, K. and Walker, J. (1994). **Practical Biochemistry**. 4<sup>th</sup> Edition, Cambridge University Press, England.
- Sawhney, S.K. and Singh, R. (2000). **Introductory Practical Biochemistry**, Narosa Publishing House, New Delhi.
- Dubey, R.C. and Maheswari, D.K. (2002). **Practical Microbiology**. S. Chand & Co. Ltd., New Delhi.
- Plummer, D.T. (1988). **An Introduction to Practical Biochemistry**. 3rd Edition, Tata Mc GrawHill, New Delhi.
- Reddy, S.M. and Reddy, S.R. (1998). **Microbiology – Practical Manual**, 3<sup>rd</sup> Edition, Sri Padmavathi Publications, Hyderabad.

## Web links

<https://vlab.amrita.edu/?sub=3&brch=73>

<https://learn.chm.msu.edu/vibl/>

<https://www.labster.com/microbiology-virtual-labs/>

<https://www.scienceprofonline.org/vmc/microbiology-laboratory-course-teaching-materials.html>


<https://virtuallabs.nmsu.edu/>

<https://www.merlot.org/merlot/viewMaterial.htm?id=79694>

## CO-PO Mapping

(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], '-' : No correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	2	3	3	3	1	2	2	3	3	3	3
CO2	3	2	3	3	2	3	3	1	3	3	3	2	3
CO3	3	3	3	3	2	2	2	2	2	3	3	2	2
CO4	3	2	2	2	2	2	3	3	1	1	2	2	2
Avg.	2.75	2.5	2.5	2.75	2.25	2.5	2.25	2	2	2.5	2.75	2.25	2.5

	<b>Government College (Autonomous) Rajahmundry</b>	<b>Program &amp; Semester</b> II B.Sc. MZC, FMZC (IV Semester)			
Course Code MBY-143	<b>TITLE OF THE COURSE</b> <b><u>MEDICAL MICROBIOLOGY AND</u></b> <b><u>IMMUNOLOGY</u></b>				
Teaching	Hours Allocated: 60 ( <b>Theory</b> )	L	T	P	C
Pre-requisites	Introductory microbiology	3	1	-	3

**Course Objectives:**

1. To study types of immunity, immune organs, cells, antibodies and antigen-antibody interactions.
2. Microbes in health & diseases, Principles of diagnosis
3. Prevention & treatment

**Course Outcomes:**

On Completion of the course, the students will be able to-	
CO1	Explain No-specific body defence and the immune response
CO2	Develop knowledge on disease transmission and control
CO3	Demonstrate on collection and handling of laboratory specimens

Skill Development- Basic Medical Lab techniques	<b>UNIT-II &amp; III</b>	Employability- Hospitals, Diagnostic labs	<b>UNIT-IV&amp;V</b>
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**UNIT-I: Immune System**

**No. of hours: 12**

Concept of Innate and Adaptive immunity

Primary and secondary organs of immune system – thymus, bursa fabricus, bone marrow, spleen, lymph nodes and lymphoid tissues

Cells of immune system- Identification and function of B and T lymphocytes, null cells, monocytes, macrophages, neutrophils, basophils and eosinophils

Complement system (in brief)

**UNIT-II : Immune response**

**No. of hours: 12**

Characteristics of antigen (Foreignness, Molecular size, Heterogeneity and solubility) haptens.

Antibodies – basic structure and types.

Generation of Immune Response - Primary and Secondary Immune Response

MHC- Functions of MHC I & II molecules

Generation of Humoral Immune Response (Plasma and Memory cells), Immune complex formation and elimination - Agglutination, Precipitation, Neutralisation, Complement fixation, Phagocytosis

Generation of Cell Mediated Immune Response

Hypersensitivity- definition and types (in brief)

**UNIT- III: Microbes in Health and Disease**

**No. of hours: 12**

Normal flora of human body.

Definitions - Infection, Invasion, Pathogen, Pathogenicity, Virulence, Toxigenicity,

Opportunistic infections, Nosocomial infections.

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

Bacterial diseases – Tuberculosis, Typhoid, Botulism

Fungal diseases – Candidiasis.

Protozoal diseases – Malaria.

Viral Diseases - Hepatitis- A and AIDS

**UNIT- IV: Principles of Diagnosis**

**No. of hours: 12**

General principles of diagnostic microbiology- Collection, transport of clinical samples

Identification by culturing

Identification by biochemical/physiological properties

Identification by molecular assays (PCR, DNA probes)

Identification by serological tests (ELISA, Immunofluorescence, Agglutination based tests, Complement fixation)

**UNIT- V: Prevention and Treatment**

**No. of hours: 12**

Vaccines – Active (Natural and recombinant) and passive

Monoclonal antibodies- Production and application

Antimicrobial agents- General modes of action of antibacterial (Penicillin, Streptomycin), antifungal (Amphotericin and Griseofulvin), antiviral (Amantadine, Acyclovir) agents

Interferons

Tests for antimicrobial susceptibility (Disc diffusion)

Antibiotic resistance in bacteria

**TEXT AND REFERENCE BOOKS:**

Reddy, S.R. and Reddy, K.R. (2006). **A Text Book of Microbiology - Immunology and Medical Microbiology**, Himalaya Publishing House, Mumbai.

Tizard, I.R. (1995). **Immunology : An Introduction**, WB Saunders, Philadelphia, USA.

Riott, I.M. (1998). **Essentials of Immunology**, ELBS and Black Well Scientific Publishers, England.

Goldsby, Kindt, T.J. and Osborne, B.A. (2004). **Kuby Immunology**, 6<sup>th</sup> Edition, W.H.Freeman and Company, New York.

Lydyard, P.M., Whelan, A. and Fanger, M.W. (2000). **Instant Notes in Immunology**, Viva Books Pvt. Ltd., New Delhi.

Chakraborty, B. (1998). **A Text Book of Microbiology**, New Central Book Agency (P) Ltd, Calcutta, India.

Ananthanarayana, R. and Panicker, C.K.S. (2000). **Text Book of Microbiology**, 6<sup>th</sup> Edition, Oriental Longman Publications, USA.

Gupte, S. (1995). **Short Text Book of Medical Microbiology**, 8<sup>th</sup> Edition, Jaypee Brothers Medical Publishers (P) Ltd, New Delhi.

- Annadurai, B. (2008). **A Textbook of Immunology and Immunotechnology**. S. Chand & Co. Ltd., New Delhi.
- Dey, N., T.K. and Sinha, D. (1999). **Medical Bacteriology Including Medical Mycology and AIDS**. New Central Book Agency (P) Ltd. Calcutta, India.
- Shetty, N. (1994). **Immunology – Introductory Textbook**. New Age International Pvt. Ltd., New Delhi.
- Singh, R.P. (2007). **Immunology and Medical Microbiology**. Kalyani Publishers, New Delhi.

**Paper-IV: Immunology and medical microbiology**

Section		Unit-I	Unit-II	Unit-III	Unit-IV	Unit-V	Total questions	No of questions answered	Marks allotted
<b>A</b>	Essay Questions	2	2	2	1	1	8	4	10x4 = 40
<b>B</b>	Short questions	2	2	2	2	2	10	5	2X5=10

**Microbiology Model Question Paper (Theory)**

TIME: 2 1/2 HOURS

Maximum Marks: 50

**Section- A**

**Answer any FIVE question**

**4×10=40 Marks**

1. a) Essay question from unit I.  
(or)  
b). Essay question from unit I
2. a) Essay question from unit II  
Or  
b) Essay question from unit II
3. a) Essay question from unit III  
(or)  
b). Essay question from unit III
4. a) Essay question from unit IV  
(or)  
b). Essay question from unit V

**Section-B**

**Answer any FIVE questions only**

**5×2=10Marks**

- 5.Short question from unit I
- 6.Short question from unit I
- 7.Short question from unit II
- 8.Short question from unit II
- 9.Short question from unit III
- 10.Short question from unit III
- 11.Short question from unit IV
- 12.Short question from unit IV
- 13.Short question from unit V
14. Short question from unit V

**Microbiology Model Question Paper (Theory)**

**MBY-140: MEDICAL MICROBIOLOGY AND IMMUNOLOGY**

**Paper: I SEMESTER –IV**

**Time: 2 1/2Hrs**

**Max.Marks:50**

**Part-A**

**Note: Answer ALL questions**

**4x10 = 40M**

1. a) What is acquired immunity and explain its important characteristics.

**OR**

b) Write a note on cells of immune system.

2. a) What is antigen and explain important characteristics of antigen.

**OR**

b) Write a note on hypersensitivity and its types.

3. a) Write a note on normal flora of human body.

**OR**

b) Give a general account on casual organism, pathogenesis, symptoms, diagnosis, treatment and prevention of malaria.

4. a) Write a note on ELISA and CFT(Complement Fixation test)

**OR**

b) Explain the production and application of monoclonal antibodies.

**Part-B**

**Answer any five questions. All carry equal marks.**

5. Lymph node

10. AIDS

6. Thymus

11. Immunofluorescence

7. MHC

12. Agglutination

8. IgM

13. Vaccines

9. TB

14. Penicillin

### Additional input

General account of COVID 19

Case studies

### Assignment questions

1. Explain Non specific defense mechanisms
2. Write a note on Cells of the immune system
3. Explain Structure of immunoglobulin
4. Write a note on Vaccines
5. Write a note on Antibacterial, antivirals & antifungals

### Web links

<https://ccelms.ap.gov.in/rusa/user/gtitles/122>

<https://www.scienceprofonline.com/virtual-micro-main.html>

<https://slidetodoc.com/history-of-microbiology-from-the-virtual-microbiology-classroom/>


<https://studylib.net/doc/5795921/microbial-growth-lecture-powerpoint>

<https://youtube.com/channel/UCAXheRahnkShRUKSRbbihuQ>

### CO-PO Mapping

(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], '-': No correlation)

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CO1	2	3	2	3	3	3	1	2	2	3	3	3	3
CO2	3	2	3	3	2	3	3	1	3	3	3	2	3
CO3	3	3	3	3	2	2	2	2	2	3	3	2	2
CO4	3	2	2	2	2	2	3	3	1	1	2	2	2
Avg.	2.75	2.5	2.5	2.75	2.25	2.5	2.25	2	2	2.5	2.75	2.25	2.5

	<b>Government College (Autonomous) Rajahmundry</b>	<b>Program &amp; Semester</b>			
Course Code MBY 143P	<b>TITLE OF THE COURSE</b>  <b><u>MEDICAL MICROBIOLOGY AND IMMUNOLOGY</u></b>	II B.Sc. MZC & FMZC (IV Semester)			
Teaching	Hours Allocated: 30 ( <b>Practical</b> )	L	T	P	C
Pre-requisites	Basic Microbiology	-	-	2	2

**TOTAL HOURS: 30**

**CREDITS: 1**

1. Identification of human blood groups.
2. Separate serum from the blood sample (demonstration).
3. Immunodiffusion by Ouchterlony method.
4. Identification of any of the bacteria (*E. coli*, *Pseudomonas*, *Staphylococcus*, *Bacillus*) using laboratory strains on the basis of cultural, morphological and biochemical characteristics: IMViC, urease production and catalase tests
5. Study of composition and use of important differential media for identification of bacteria: EMB Agar, McConkey agar, Mannitol salt agar, Deoxycholate citrate agar, TCBS Isolation of bacterial flora of skin by swab method.
6. Antibacterial sensitivity by Kirby-Bauer method
7. Determination of minimal inhibitory concentration of an antibiotic
8. Study symptoms of the diseases with the help of photographs: Anthrax, Polio, Herpes, chicken pox, HPV warts, Dermatomycoses (ring worms)
9. Study of various stages of malarial parasite in RBCs using permanent mounts.

#### REFERENCE BOOKS

- Talwar, G.P. and Gupta, S.K. (1992). **A Hand Book of Practical and Clinical Immunology**. CBS Publications, New Delhi.
- Baren, E.J. (1994). **Bailey and Scott's Diagnostic Microbiology**, 9<sup>th</sup> Edition, Mosby Publishers.
- Dubey, R.C. and Maheswari, D.K. (2002). **Practical Microbiology**, S. Chand & Co., New Delhi.
- Samuel, K.M. (Ed.) (1989). **Notes on Clinical Lab Techniques**, M.K.G. Iyyer & Son Publishers, Chennai.
- Wadher, B.J. and Reddy, G.L.B. (1995). **Manual of Diagnostic Microbiology**, Himalaya Publishing House, Mumbai.
- Dey, N.C., Dey, T.K., Dey, M. and Sinha, D. (1998). **Practical Microbiology, Protozoology, and Parasitology**. New Central Book Agency (P) Ltd. Calcutta.

## Web links

<https://vlab.amrita.edu/?sub=3&brch=73>

<https://learn.chm.msu.edu/vibl/>

<https://www.labster.com/microbiology-virtual-labs/>

<https://www.scienceprofonline.org/vmc/microbiology-laboratory-course-teaching-materials.html>


<https://virtuallabs.nmsu.edu/>

<https://www.merlot.org/merlot/viewMaterial.htm?id=79694>

## CO-PO Mapping

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	2	3	3	3	1	2	2	3	3	3	3
CO2	3	2	3	3	2	3	3	1	3	3	3	2	3
CO3	3	3	3	3	2	2	2	2	2	3	3	2	2
CO4	3	2	2	2	2	2	3	3	1	1	2	2	2
Avg.	2.75	2.5	2.5	2.75	2.25	2.5	2.25	2	2	2.5	2.75	2.25	2.5

	<b>Government College (Autonomous) Rajahmundry</b>	<b>Program &amp; Semester</b> II B.Sc. MZC, FMZC (IV Semester)			
Course Code MBY-144	<b>TITLE OF THE COURSE</b> <b><u>MICROBIAL ECOLOGY AND INDUSTRIAL</u></b> <b><u>MICROBIOLOGY</u></b>				
Teaching	Hours Allocated: 60 ( <b>Theory</b> )	L	T	P	C
Pre-requisites	Introductory microbiology	3	1	-	3

**TOTAL HOURS: 60**

**CREDITS: 4**

**Course Objectives:**

1. To study role of microorganisms in nutrient cycling, microorganism in waste treatment and degradation of xenobiotics
2. To determine the potability of drinking water
3. To study concepts of screening and strain improvement

**Course Outcomes:**

On Completion of the course, the students will be able to-

CO1	Understand fundamental concept in soil microbial diversity, basic concept of biogeochemical cycles and plant growth promotion and plant diseases
CO2	Understands the role of microorganisms in treatment of solid and liquid waste.
CO3	Acquire knowledge on application of microorganisms in agro – environmental fields.
CO4	Get basic information design of fermenter, fermentation processes and Single cell proteins.

Skill Development- Screening techniques, Industrial productions Practicals, Study projects Internships	<b>UNIT- II,III, IV &amp; V</b>	Employability- Production, Q& C, R& D Food & Industrial Microbiology	<b>UNIT- II,III, IV &amp; V</b>	Entrepreneurship Startups in Food & Industrial Microbiology	<b>UNIT- II,III, IV &amp; V</b>
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**UNIT – I: Microorganisms in environment**

**No. of hours: 12**

Role of microorganisms in Biogeochemical cycles (Carbon, nitrogen, phosphorus)  
 Microbe-microbe interactions – Synergism, mutualism, commensalism, antagonism, competition, parasitism, predation,  
 Plant- Microbe interactions – Plant growth promoting Microorganisms, Plant pathogens  
 Extremophilic microorganisms

**UNIT – II : Microorganisms in Food and Water**

**No. of hours: 12**

Microbes in waste management- solid and liquid waste (aerobic and anaerobic)

Microbes in degradation of Xenobiotics

Microbes in drinking water- detection of potability by (a) standard qualitative procedure: presumptive test/MPN test, confirmed and completed tests for faecal coliforms (b) Membrane filter technique, Microbes in food –intrinsic and extrinsic parameters that affect microbial growth in food

### **UNIT – III: Industrial Microbiology**

**No. of hours: 12**

Microorganisms of industrial importance – yeasts (*Saccharomyces cerevisiae*), moulds (*Aspergillus niger*) bacteria (*E.coli*), actinomycetes (*Streptomyces griseus*).

Screening techniques.

Industrially important Primary and secondary microbial metabolites - Techniques involved in selection of industrially important metabolites from microbes.

### **UNIT – IV: Fermentation processes**

**No. of hours: 12**

Design of fermenter (for control of pH, temperature, dissolved oxygen, foaming and aeration)

Types of fermenter – batch, continuous and fed batch.

Types of fermentation processes – solid state, liquid state, batch, fed-batch, continuous.

Fermentation media (Crude and synthetic media; molasses, corn- steep liquor, sulphite waste liquor, whey, yeast extract and protein hydrolysates)

Downstream processing - filtration, centrifugation, cell disruption, solvent extraction.

### **UNIT – V: Microbial Productions**

**No. of hours: 12**

Microbial production of Industrial products: Citric acid, Ethanol, Penicillin, Glutamic acid, vitamin B12, Amylase, Yogurt

Microbial cells as food- SCP

### **TEXT AND REFERENCE BOOKS:**

Atlas, R.M. and Bartha, R. (1998). **Microbial Ecology - Fundamentals and Applications**, Addison Wesley Longman, Inc., USA

Paul, E.A. and Clark, F.E. (1989). **Soil Microbiology and Biochemistry**, Academic Press, USA.

Lynch, J.M. and Poole, N.J. (1979). **Microbial Ecology – A Conceptual Approach**, Blackwell Scientific Publications, USA

Stanbury, P.F., Whitaker, A. and Hall, S.J. (1997). **Principles of Fermentation Technology**, Aditya Books (P) Ltd. New Delhi.

Doyle, M.P., Beuchat, L.R. and Montville, T.J. (1997). **Food Microbiology: Fundamentals and Frontiers**. ASM Press, Washington D.C., USA.

Patel, A.H. (1984). **Industrial Microbiology**, Mac Milan India Ltd., Hyderabad.

Cassida, L.E. (1968). **Industrial Microbiology**, Wiley Eastern Ltd. & New Age International Ltd., New Delhi.

Crueger, W. and Crueger, A. (2000). **Biotechnology – A Text Book of Industrial Microbiology**, Panima Publishing Corporation, New Delhi

Reed, G. (Ed.) (1987). **Prescott & Dunn's Industrial Microbiology**, 4<sup>th</sup> Edition, CBS Publishers & Distributors, New Delhi.

Subba Rao, N.S. (1999). **Soil Microorganisms and Plant Growth**. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Reddy, S.R. and Singara Charya, M.A. (2007). **A Text Book of Microbiology - Applied Microbiology**. Himalaya Publishing House, Mumbai.

**Semester IV Paper-II : MICROBIAL ECOLOGY AND INDUSTRIAL MICROBIOLOGY**

Section		Unit-I	Unit-II	Unit-III	Unit-IV	Unit-V	Total questions	No of questions answered	Marks allotted
A	Essay Questions	2	2	2	1	1	8	4	10x4 = 40
B	Short questions	2	2	2	2	2	10	5	2X5=10

**Microbiology Model Question Paper (Theory)**

TIME: 2 1/2 HOURS

Maximum Marks: 50

**Section- A**

**Answer any FIVE question**

**4×10=40 Marks**

1. a) Essay question from unit I.  
(or)  
b). Essay question from unit I
2. a) Essay question from unit II  
Or  
b) Essay question from unit II
3. a) Essay question from unit III  
(or)  
b). Essay question from unit III
4. a) Essay question from unit IV  
(or)  
b). Essay question from unit V

**Section-B**

**Answer any FIVE questions only**

**5×2=10Marks**

- 5.Short question from unit I
- 6.Short question from unit I
- 7.Short question from unit II
- 8.Short question from unit II
- 9.Short question from unit III
- 10.Short question from unit III
- 11.Short question from unit IV
- 12.Short question from unit IV
- 13.Short question from unit V
14. Short question from unit V

**Microbiology Model Question Paper (Theory)**

**MBY-140: MICROBIAL ECOLOGY AND INDUSTRIAL MICROBIOLOGY**

**SEMESTER –IV Paper: II**

**Time: 2 1/2Hrs**

**Max.Marks:50**

**Part-A**

**Note: Answer ALL questions**

**4x10 = 40M**

1. a) Explain role of micro organisms in carbon cycle.

OR

b) Write a note on Plant growth promoting Rhizobacteria.

2. a) Explain the role of Micro organisms in Solid waste management.

OR

b) Explain biological waste water treatment.

3. a) Explain industrial importance of yeast and moulds.

OR

b) Write a note on Primary screening methods.

4. a) Explain design of an Industrial fermentator.

OR

b) Explain the industrial production of Vitamin B12

**Part-B**

**Answer any five questions. All carry equal marks.**

5. Mutualism

10. Difference between primary and secondary metabolites

6. Antagonism

11. Batch fermentation

7. Membrane filter technique

12. Molasses

8. Define Bio-remediation

13. Yogurt

9. Streptomyces griseus

14. SCP

### Additional input

Solid waste management in Rajahmundry  
Studies on SWL from Paper mill in Rajahmundry  
Industrial production of wine & beer

### Assignment questions

1. Explain role of microorganisms in biogeochemical cycles.
2. Explain various microbial interactions.
3. Primary screening techniques
4. Design of fermenter
5. Industrial fermentation media
6. Various industrial fermentations

### Web links

<https://ccelms.ap.gov.in/rusa/user/gtitles/122>

<https://www.scienceprofonline.com/virtual-micro-main.html>

<https://slidetodoc.com/history-of-microbiology-from-the-virtual-microbiology-classroom/>


<https://studylib.net/doc/5795921/microbial-growth-lecture-powerpoint>

<https://youtube.com/channel/UCAXheRahnkShRUKSRbbihuQ>

### CO-PO Mapping

(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], '-': No correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	2	3	3	3	1	2	2	3	3	3	3
CO2	3	2	3	3	2	3	3	1	3	3	3	2	3
CO3	3	3	3	3	2	2	2	2	2	3	3	2	2
CO4	3	2	2	2	2	2	3	3	1	1	2	2	2
Avg.	2.75	2.5	2.5	2.75	2.25	2.5	2.25	2	2	2.5	2.75	2.25	2.5

	<b>Government College (Autonomous) Rajahmundry</b>	<b>Program &amp; Semester</b>			
Course Code MBY 144P	<b>TITLE OF THE COURSE</b>  <b><u>MICROBIAL ECOLOGY AND INDUSTRIAL MICROBIOLOGY</u></b>	II B.Sc. MZC & FMZC (IV Semester)			
Teaching	Hours Allocated: 30 ( <b>Practical</b> )	L	T	P	C
Pre-requisites	Basic Microbiology	-	-	2	2

1. Microbial fermentation for the production and estimation of ethanol
2. Isolation of amylase producing microorganisms from soil
3. Production of amylase from bacteria and fungi
4. Assay of amylase
5. Demonstration of fermenter
6. Production of wine from grapes
7. Growth curve and kinetics of any two industrially important microorganisms.
8. Microbial fermentation for the production and estimation of citric acid


### Web links

<https://vlab.amrita.edu/?sub=3&brch=73>  
<https://learn.chm.msu.edu/vibl/>  
<https://www.labster.com/microbiology-virtual-labs/>  
<https://www.scienceprofonline.org/vmc/microbiology-laboratory-course-teaching-materials.html>  
<https://virtuallabs.nmsu.edu/>  
<https://www.merlot.org/merlot/viewMaterial.htm?id=79694>

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	2	3	3	3	1	2	2	3	3	3	3
CO2	3	2	3	3	2	3	3	1	3	3	3	2	3
CO3	3	3	3	3	2	2	2	2	2	3	3	2	2
CO4	3	2	2	2	2	2	3	3	1	1	2	2	2
Avg.	2.75	2.5	2.5	2.75	2.25	2.5	2.25	2	2	2.5	2.75	2.25	2.5

	<b>Government College (Autonomous) Rajahmundry</b>	<b>Program &amp; Semester</b> III B.Sc. MZC, FMZC (V Semester)			
Course Code MBY-140 A1	<b>TITLE OF THE COURSE</b> <b>FOOD, AGRICULTURE AND ENVIRONMENTAL MICROBIOLOGY</b>				
Teaching	Hours Allocated: 60 ( <b>Theory</b> )	L	T	P	C
Pre-requisites	Introductory microbiology	3	1	-	3

**Aim and objectives of Course**

To provide knowledge on important microbes in food, Agriculture and Environmental Microbiology

**Learning Outcomes of Course**

Up on completion of the course students able to

**CO1:** Demonstrate with the wide diversity of microbes and their spoilage food, food intoxication and food born infections

**CO2:** Able to understand principles of food preservation, fermented foods and microbes as food.

**CO3:** The student will acquire knowledge on application of microorganisms in agro – environmental fields

**CO4:** Get fundamental concepts in principles of plant disease control an industrial application of Microbiology

**CO5:** The student will have fundamental concepts in soil microbiology and soil water and aero microbial diversity and microbial interactions Basic concepts in treatment of drinking water. Understands the role of microorganisms in treatment of solid and liquid waste.

**UNIT – 1****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: 8**

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: 8**

Soil Microbiology: Microbial groups in soil, microbial transformations of carbon, nitrogen, phosphorus and sulphur.

Biological nitrogen fixation.

Microflora of Rhizosphere and Philosopher microflora, microbes in composting.

Importance of mycorrhizal inoculums, types of mycorrhizae associated plants, mass inoculums. Production of VAM, field applications of Ectomycorrhizae.

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

Beneficial microorganisms in Agriculture: Biofertilizer (Bacterial Cyanobacterial and Fungal), microbial insecticides, Microbial agents for control of Plant diseases.

Plant – Microbe interactions.

Diseases caused by bacteria and fungi to various commercial crops: groundnut rust & Citrus canker and food crops: **Rice Blast** (*Pyriculariaoryzae*) Bacterial blight of rice (*Oryzasativa* and *O. glaberrima*)

Biodegradation, Biogas production, Biodegradable plastics.

### **UNIT – V**

**No. of Hours: 12**

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

Methods to detect portability of water samples.

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 and tertiary sewage treatment.

### **TEXT & REFERENCE BOOKS**

Doyle, M.P., Beuchat, L.R. and Montville, T.J. (1997). **Food Microbiology: Fundamentals and Frontiers**. ASM Press, Washington D.C., USA.

Frazier, W.C. and Westhoff, D.C. (1988). **Food Microbiology**, Mc Graw-Hill, New York.

Jay, J.M. (1996). **Modern Food Microbiology**, Chapman and Hall, New York.

Ray, B. (1996). **Fundamentals of Food Microbiology**, CRC Press, USA.

Subba Rao, N.S. (1993). **Biofertilizers in Agriculture and Forestry**, 3<sup>rd</sup> Edition Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Rangaswami, G. and Bhagyaraj, D.J. (2001). **Agricultural Microbiology**, 2<sup>nd</sup> Edition, Prentice Hall of India, New Delhi.

Atlas, R.M. and Bartha, R. (1998). **Microbial Ecology - Fundamentals and Applications**, Addison Wesley Longman, Inc., USA

Paul, E.A. and Clark, F.E. (1989). **Soil Microbiology and Biochemistry**, Academic Press, USA.

### III B.Sc Microbiology ,Semester -V

#### Blue Print For MB T A1: FOOD, AGRICULTURE AND ENVIRONMENTAL MICROBIOLOGY

Section		Unit-I	Unit-II	Unit-III	Unit-IV	Unit-V	Total questions	No of questions answered	Marks allotted
<b>A</b>	Essay Questions	2	2	2	1	1	8	4	10x4 = 40
<b>B</b>	Short questions	2	2	2	2	2	10	5	2X5=10

**Total Marks= 50**

#### Microbiology Model Question Paper (Theory)

TIME: 2 1/2 HOURS

Maximum Marks: 50

#### Section- A

**Answer any FIVE question**

**4×10=40 Marks**

1. a) Essay question from unit I.  
(or)  
b). Essay question from unit I
2. a) Essay question from unit II  
Or  
b) Essay question from unit II
3. a) Essay question from unit III  
(or)  
b). Essay question from unit III
4. a) Essay question from unit IV  
(or)  
b). Essay question from unit V

#### Section-B

**Answer any FIVE questions only**

**5×2=10Marks**

- 5.Short question from unit I
- 6.Short question from unit I
- 7.Short question from unit II
- 8.Short question from unit II
- 9.Short question from unit III
- 10.Short question from unit III
- 11.Short question from unit IV
- 12.Short question from unit IV
- 13.Short question from unit V
- 14 Short question from unit VI

**Microbiology Model Question Paper (Theory)**

**MBY-140 FOOD, AGRICULTURE AND ENVIRONMENTAL MICROBIOLOGY**

**Paper: II SEMESTER –IV**

**Time: 2 1/2Hrs**

**Max.Marks:50**

**Part-A**

**Note: Answer ALL questions**

a) Explain extrinsic parameters that affect microbial growth in food

**OR**

b) Write a note on botulism

2. a) Explain production of cheese.

**OR**

b) Write a note on probiotics and its health benefits.

3. a) Explain the role of microorganisms in the sulphur cycle.

**OR**

b) Explain biological nitrogen fixation.

4. a) Write a note on biofertilizers.

**OR**

b) Explain micro flora of freshwater and Marine habitats.

**Part-B**

**Answer any five questions. All carry equal marks.**

5. Salmonellosis

10. Phosphorus cycle

6. Microbial spoilage of canned foods

11. Groundnut rust

7. Yoghurt

12. Biodegradable plastics

8. SCP

13. Sanitary landfill

9. VAM

14. BOD

**Additional input**

1. Indian fermented foods- Idli, Dosa, Dhokla
2. Study Solid waste management in Rajahmundry
3. Student projects on quality of water

**Assignment questions**

1. Food spoilage
2. Principles of food preservation - Physical and chemical methods
3. Soil Microbiology
4. Biofertilizer
5. Solid Waste management
6. Liquid waste management

**Web links**

<https://ccelms.ap.gov.in/rusa/user/gtitles/122>

<https://www.scienceprofonline.com/virtual-micro-main.html>

<https://slidetodoc.com/history-of-microbiology-from-the-virtual-microbiology-classroom/>


<https://studylib.net/doc/5795921/microbial-growth-lecture-powerpoint>

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**CO-PO Mapping**

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CO2	3	2	3	3	2	3	3	1	3	3	3	2	3
CO3	3	3	3	3	2	2	2	2	2	3	3	2	2
CO4	3	2	2	2	2	2	3	3	1	1	2	2	2
Avg.	2.75	2.5	2.5	2.75	2.25	2.5	2.25	2	2	2.5	2.75	2.25	2.5

	<b>Government College (Autonomous) Rajahmundry</b>	<b>Program &amp; Semester</b>			
Course Code MBY 145P AI	<b>TITLE OF THE COURSE</b> <b>FOOD, AGRICULTURE AND ENVIRONMENTAL MICROBIOLOGY</b>	III B.Sc. MZC & FMZC (V Semester)			
Teaching	Hours Allocated: 30 ( <b>Practical</b> )	L	T	P	C
Pre-requisites	Basic Microbiology	-	-	2	2

**Total hours: 40****Credits: 2**

1. Isolation of bacteria and fungi spoiled bread / fruits / vegetables
2. Preparation of yogurt / dahi
3. Determination of microbiological quality of milk sample by MBRT
4. Enumeration of bacteria, fungi and actinomycetes from soil
5. Enumeration and identification of rhizosphere micro flora
6. Isolation of rhizobium from root nodules.
7. Isolation of azatobacter from soil.
8. Observation description of any three bacterial and fungal plant diseases
9. Staining and observation of VAM.
10. Analysis of soil - pH, Moisture content and water holding capacity.
11. Study of air flora by petriplate exposure method.
12. Analysis of potable water: SPC, Presumptive, confirmed and completed test, determination of coli form count in water by MPN.
13. Determination of Biological Oxygen Demand (BOD) of waste water samples.

**SUGGESTED READINGS:**

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

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

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

Lynch JM & Hobbie JE. (1988). Microorganisms in Action: Concepts & Application in Microbial Ecology. Blackwell Scientific Publication, U.K.

Madigan MT, Martinko JM and Parker J. (2014). Brock Biology of Microorganisms. 14th edition. Pearson/ Benjamin Cummings.

Maier RM, Pepper IL and Gerba CP. (2009). Environmental Microbiology. 2nd edition, Academic Press.

Martin A. (1977). An Introduction to Soil Microbiology. 2nd edition. John Wiley & Sons Inc. New York & London.

Singh A, Kuhad, RC & Ward OP (2009). Advances in Applied Bioremediation. Volume 17, Springer-Verlag, Berlin Hedeilberg

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

Subba Rao NS. (1999). Soil Microbiology. 4th edition. Oxford & IBH Publishing Co. New Delhi.

Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott's Microbiology. 9th edition. McGraw Hill Higher Education.

### Web links

<https://vlab.amrita.edu/?sub=3&brch=73>

<https://learn.chm.msu.edu/vibl/>

<https://www.labster.com/microbiology-virtual-labs/>

<https://www.scienceprofonline.org/vmc/microbiology-laboratory-course-teaching-materials.html>


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<https://www.merlot.org/merlot/viewMaterial.htm?id=79694>

### CO-PO Mapping

(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], '-': No correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	2	3	3	3	1	2	2	3	3	3	3
CO2	3	2	3	3	2	3	3	1	3	3	3	2	3
CO3	3	3	3	3	2	2	2	2	2	3	3	2	2
CO4	3	2	2	2	2	2	3	3	1	1	2	2	2
Avg.	2.75	2.5	2.5	2.75	2.25	2.5	2.25	2	2	2.5	2.75	2.25	2.5

	<b>Government College (Autonomous) Rajahmundry</b>	<b>Program &amp; Semester</b> III B.Sc. MZC, FMZC ( V Semester)			
Course Code MBY-145 A2	<b>TITLE OF THE COURSE</b> <b>MANAGEMENT OF HUMAN MICROBIAL DISEASES AND DIAGNOSIS</b>				
Teaching	Hours Allocated: 60 ( <b>Theory</b> )	L	T	P	C
Pre-requisites	Introductory microbiology	3	1	-	3

**Aim and objectives of Course**

To realize the principles of prevention and treatment of microbial diseases and to understand the concepts and development of microbial diseases in animals

**Learning outcomes of Course**

Up on completion of the course students able to

**CO1:** Develop knowledge and skills on microbiological laboratory skills for identification of pathogens

**CO2:** Students will demonstrate the collection of clinical samples

**CO3:** Students will get knowledge on staining techniques

**CO4:** Students able to perform diagnostic techniques

**CO5:** To understand drug resistance

**UNIT – I****No.of Hours: 8**

Definition and concept of health, disease, infection, and pathogen.

Bacterial Diseases: Cholera, Pneumonia, and Dysentery.

Viral Diseases: COVID-19, Poliomyelitis & Chicken pox

Fungal diseases: Dermatormycosis and Athletes foot.

Protozoan Diseases: Amoebiasis.

**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**

Mechanism of bacterial pathogenicity, colonization and growth, virulence, virulence factors, exotoxins, enterotoxins, endotoxins and neurotoxins.

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, Mac Conkey 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.

Diagnosis of 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. Problems of drug resistance and drug sensitivity.  
Drug resistance in bacteria.

**SUGGESTED READING**

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

Reddy, S.R. and Reddy, K.R. (2006). **A Text Book of Microbiology - Immunology and Medical Microbiology**, Himalaya Publishing House, Mumbai.

Gupte, S. (1995). **Short Text Book of Medical Microbiology**, 8<sup>th</sup> Edition, Jaypee Brothers Medical Publishers (P) Ltd, New Delhi.

### III B.Sc Microbiology ,Semester -V

#### Blue Print For MB T A2 MANAGEMENT OF HUMAN MICROBIAL DISEASES AND DIAGNOSIS

Section		Unit-I	Unit-II	Unit-III	Unit-IV	Unit-V	Total questions	No of questions answered	Marks allotted
<b>A</b>	Essay Questions	2	2	2	1	1	8	4	10x4 = 40
<b>B</b>	Short questions	2	2	2	2	2	10	5	2X5=10

**Total Marks= 50**

#### Microbiology Model Question Paper (Theory)

TIME: 2 1/2 HOURS

Maximum Marks: 50

#### Section- A

**Answer any FIVE question**

**4×10=40 Marks**

1. a) Essay question from unit I.  
(or)  
b). Essay question from unit I
2. a) Essay question from unit II  
Or  
b) Essay question from unit II
3. a) Essay question from unit III  
(or)  
b). Essay question from unit III
4. a) Essay question from unit IV  
(or)  
b). Essay question from unit V

#### Section-B

**Answer any FIVE questions only**

**5×2=10Marks**

- 5.Short question from unit I
- 6.Short question from unit I
- 7.Short question from unit II
- 8.Short question from unit II
- 9.Short question from unit III
- 10.Short question from unit III
- 11.Short question from unit IV
- 12.Short question from unit IV
- 13.Short question from unit V
- 14 Short question from unit VI

**Microbiology Model Question Paper (Theory)**

**MBY-140: MANAGEMENT OF HUMAN MICROBIAL DISEASES AND DIAGNOSIS**

**Paper: II SEMESTER –IV**

**Time: 2 1/2Hrs**

**Max.Marks:50**

**Part-A**

**Note: Answer ALL questions**

1. a) Write the causative agent, pathogenesis, symptoms, diagnosis, treatment and prevention of Cholera.

**OR**

b) Write the causative agent, pathogenesis, symptoms, diagnosis, treatment and prevention of Dermatomycosis.

2. a) explain collection of clinical samples and precautions required.

**OR**

b) explain method of transport of clinical samples to laboratory and storage.

3. a) explain the principle and procedure of ziehl-nelson stain for tuberculosis.

**OR**

b) write the preparation and use of blood and lowenstein-jenson medium.

4. a) write the use of PCR in diagnostics.

**OR**

b) write a note on drug resistance in bacteria.

**Part-B**

**Answer any five questions. All carry equal marks.**

5. Polio

10. Mac. Conkey agar

6. Covid 19

11. ELISA

7. Throats swab


12. Nucleic acid probes

8. CSF

13. MIC

9. Exotoxins

14. Anti-microbial Sensitivity test

	<b>Government College (Autonomous) Rajahmundry</b>	<b>Program &amp; Semester</b>			
Course Code MBY 145P A2	<b>TITLE OF THE COURSE</b>  <b>MANAGEMENT OF HUMAN MICROBIAL DISEASES AND DIAGNOSIS</b>	III B.Sc. MZC & FMZC (V Semester)			
Teaching	Hours Allocated: 30 ( <b>Practical</b> )	L	T	P	C
Pre-requisites	Basic Microbiology	-	-	2	2

1. Collection transport and processing of clinical specimens (Blood, Urine, Stool and Sputum).

Receipts, Labelling, recording and dispatching clinical specimens.

2. Physical, Chemical & microscopic examination of clinical samples – urine, stool, puss, sputum.

3. Isolation and identification of following pathogens from clinical samples: *E.coli*, *Salmonella* and *Pseudomonas*.

4. Demonstration of permanent slides of the following parasites:

a) *Entamoeba histolytica*

b) *Ascaris* spp.

c) *Plasmodium* spp.

d) *Mycobacterium tuberculosis* & *Mycobacterium leprae*

5. Estimation of haemoglobin (Acid haematin and cyan methanoglobin method).

6. ESR and PCV determination.

7. Immuno hematology: Blood group typing by slide test & tube for ABO & Rh systems.

8. Isolation of bacteria in pure culture and Antibiotic sensitivity.

### **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.

**Additional inputs**

1. Study Visit to clinical laboratories
2. Community projects on Communicable diseases
3. Guest lectures/ interactive classes with medical laboratory technicians
4. Conduct surveys on epidemiology of certain diseases.

**Assignment questions**

1. Write notes on viral diseases
2. Different methods of transport of clinical samples
3. Write an essay on Virulence factors of Bacteria and Viruses
4. Write about drug resistance and drug sensitivity.

**Web links**

<https://vlab.amrita.edu/?sub=3&brch=73>

<https://learn.chm.msu.edu/vibl/>

<https://www.labster.com/microbiology-virtual-labs/>

<https://www.scienceprofonline.org/vmc/microbiology-laboratory-course-teaching-materials.html>


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CO2	3	2	3	3	2	3	3	1	3	3	3	2	3
CO3	3	3	3	3	2	2	2	2	2	3	3	2	2
CO4	3	2	2	2	2	2	3	3	1	1	2	2	2
Avg.	2.75	2.5	2.5	2.75	2.25	2.5	2.25	2	2	2.5	2.75	2.25	2.5

	<b>Government College (Autonomous) Rajahmundry</b>	<b>Program &amp; Semester</b> III B.Sc. MZC, FMZC (V Semester)			
Course Code MBY-145 B1	<b>TITLE OF THE COURSE</b> <b>MICROBIAL BIOTECHNOLOGY AND r – DNA TECHNOLOGY</b>				
Teaching	Hours Allocated: 60 ( <b>Theory</b> )	L	T	P	C
Pre-requisites	Introductory microbiology	3	1	-	3

**Aim and objectives of Course**

To study applications of microbial biotechnology and r DNA technology.

**Learning outcomes of Course**

Up on completion of the course students able to

**CO1:** Students should be able to demonstrate with the wide diversity of microbes and their potential use in medicine, agriculture and industry biotechnology regulation and ethics.

**CO2:** Students will get knowledge on restriction endonuclease in r DNA technology and selection of transformed cells

**CO3:** Students will get knowledge on cloning vehicles in r DNA technology

**CO4:** Student will able to understand gene sequencing methods

**CO5:** Students will get knowledge on of genetically modified crops. And role of microorganisms in creation of transgenic animals and plants.

**UNIT – I****No. of hours: 8**

Introduction to microbial biotechnology, Bacterial genes, genomes and genetics. Recombinant microbial biotechnology products, biotechnology regulation and ethics. Biomass and bio fuels: plant biomass (cellulose, starch, pectin, gum materials). Animal biomass (chitin, milk, whey, slaughter, house waste). Microbial biomass (algal blooms, in fresh and sea water), fungal mushrooms, fermentation waters by yeasts, and bacterial biomass.

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

**Restriction and Modification:** Classification of restriction endonucleases. Enzymes used in molecular cloning; Polymerases, ligases, phosphatases, kinases and nucleases; Advanced Molecular biology techniques, Electrophoresis and Blotting techniques.

**Cutting and joining DNA:** (cohesive end ligation, methods of blunt end ligation).

Transfection and transformation. Selection of transformed cells. Screening methods (Genetic marker and blue white screening).

**UNIT- III****No. of hours: 7**

**Cloning vehicles** - Plasmid, Bacteriophage, Construction of genomic and cDNA libraries.

Advantages of cDNA libraries. Concept of single cell proteins, probiotics and their applications. Microbial production of fuels: alcohols, hydrogen and methane. Microbial production of polymers: xanthenes gums.

**UNIT- IV****No. of hours: 7**

Methods of gene sequencing – Maxam - Gilberts and Sanger's dideoxy chain termination methods; Polymerase chain reaction technique (Components in PCR and PCR conditions).

Methods of gene transfer in fungi, yeast and higher plants using microinjection, microprojectile bombardment (gene gun method, Electroporation and *Agrobacterium* mediated transformation.

Expression of cloned genes in bacteria, yeast, plant and animal cells.

Basic principles and application of biosensors. Nucleic acid probe technology.

**UNIT- V**

**No. of hours: 7**

Concept of genetically modified microorganisms. Bt cotton : production, advantages and limitations.

Probable advantages and disadvantages of genetically modified crops.

Role of microorganisms in creation of transgenic animals and plants.

**TEXT & REFERENCE BOOKS**

- Freifelder, D. (1990). Microbial Genetics. Narosa Publishing House, New Delhi.
- Freifelder, D. (1997). Essentials of Molecular Biology. Narosa Publishing House, New Delhi.
- Glick, B.P. and Pasternack, J. (1998). Molecular Biotechnology, ASM Press, Washington D.C., USA.
- Lewin, B. (2000). Genes VIII. Oxford University Press, England.
- Maloy, S.R., Cronan, J.E. and Freifelder, D. (1994). Microbial Genetics, Jones and Bartlett Publishers, London.
- 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,
- Strickberger, M.W. (1967). Genetics. Oxford & IBH, New Delhi.

**III B.Sc Microbiology ,Semester -V****Blue Print For MB T B1 -Microbial Biotechnology & r – DNA Technology**

Section		Unit-I	Unit-II	Unit-III	Unit-IV	Unit-V	Total questions	No of questions answered	Marks allotted
<b>A</b>	Essay Questions	2	2	2	1	1	8	4	10x4 = 40
<b>B</b>	Short questions	2	2	2	2	2	10	5	2X5=10

**Total Marks= 50****Microbiology Model Question Paper (Theory)**

TIME: 2 1/2 HOURS

Maximum Marks: 50

**Section- A****Answer any FIVE question****4×10=40 Marks**

1. a) Essay question from unit I.  
(or)  
b). Essay question from unit I
2. a) Essay question from unit II  
Or  
b) Essay question from unit II
3. a) Essay question from unit III  
(or)  
b). Essay question from unit III
4. a) Essay question from unit IV  
(or)  
b). Essay question from unit V

**Section-B****Answer any FIVE questions only****5×2=10Marks**

- 5.Short question from unit I
- 6.Short question from unit I
- 7.Short question from unit II
- 8.Short question from unit II
- 9.Short question from unit III
- 10.Short question from unit III
- 11.Short question from unit IV
- 12.Short question from unit IV
- 13.Short question from unit V
- 14 Short question from unit V

**Microbiology Model Question Paper (Theory)**

**MBY-140: MICROBIAL BIOTECHNOLOGY AND r – DNA TECHNOLOGY**

**Paper: II SEMESTER –IV**

**Time: 2 1/2Hrs**

**Max.Marks:50**

**Part-A**

**Note: Answer ALL questions**

1.a) Write a note on plant biomass

**OR**

b) Write a note on microbial biomass

2. a) Write a note on enzymes used in genetic engineering.

**OR**

b) What are the general screening methods in genetic engineering for selection of bacteria with rDNA.

3. a) Write a note on commonly used cloning vectors in rDNA technology.

**OR**

b) Explain microbial production of Xanthum gum.

4. a) Write a note on basic principles and applications of biosensors.

**OR**

b) Write a note on BT cotton.

**Part-B**

**Answer any five questions. All carry equal marks.**

5. Bio ethics

10. SCP

6. Whey

11. Gene-gun method

7. Blunt and ligation

12. Micro injection

8. Transfection

13. Transgenic animals

9. C-DNA

14. GMO's

**ASSIGNMENT QUESTIONS**

1. Explain biofuels
2. Outlines of gene cloning
3. Methods of gene sequencing
4. Genetically modified crops

**Web links**

<https://ccelms.ap.gov.in/rusa/user/gtitles/122>

<https://www.scienceprofonline.com/virtual-micro-main.html>

<https://slidetodoc.com/history-of-microbiology-from-the-virtual-microbiology-classroom/>

<https://studylib.net/doc/5795921/microbial-growth-lecture-powerpoint>


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**CO-PO Mapping**

(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], '-': No correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	2	3	3	3	1	2	2	3	3	3	3
CO2	3	2	3	3	2	3	3	1	3	3	3	2	3
CO3	3	3	3	3	2	2	2	2	2	3	3	2	2
CO4	3	2	2	2	2	2	3	3	1	1	2	2	2
Avg.	2.75	2.5	2.5	2.75	2.25	2.5	2.25	2	2	2.5	2.75	2.25	2.5

**MBT- BI :MICROBIAL BIOTECHNOLOGY AND r – DNA TECHNOLOGY**

	<b>Government College (Autonomous) Rajahmundry</b>	<b>Program &amp; Semester</b>			
Course Code MBY 145P B1	<b>TITLE OF THE COURSE</b>  <b>MICROBIAL BIOTECHNOLOGY AND r – DNA TECHNOLOGY</b>	III B.Sc. MZC & FMZC ( V Semester)			
Teaching	Hours Allocated: 30 ( <b>Practical</b> )	L	T	P	C
Pre-requisites	Basic Microbiology	-	-	2	2

**TOTALHOURS: 36****CREDITS: 2**

1. Culturing of mushrooms
2. Isolation of yeast from grapes.
3. Production of wine
4. Production of ethyl alcohol
5. Isolation of Plasmid DNA from E.coli
6. Tissue culture: callus cultivation
7. Fermentative production of ethyl alcohol
8. Transformation in Bacteria using plasmid.
9. Restriction digestion of DNA and its electrophoretic separation.
10. Ligation of DNA molecules and their testing using electrophoresis.
11. Activity of DNAase and RNAase on DNA and RNA.
12. Isolation of Plasmid DNA.
13. Demonstration of PCR.

**Web links**

<https://vlab.amrita.edu/?sub=3&brch=73>

<https://learn.chm.msu.edu/vibl/>

<https://www.labster.com/microbiology-virtual-labs/>

<https://www.scienceprofonline.org/vmc/microbiology-laboratory-course-teaching-materials.html>

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CO1	2	3	2	3	3	3	1	2	2	3	3	3	3
CO2	3	2	3	3	2	3	3	1	3	3	3	2	3
CO3	3	3	3	3	2	2	2	2	2	3	3	2	2
CO4	3	2	2	2	2	2	3	3	1	1	2	2	2
Avg.	2.75	2.5	2.5	2.75	2.25	2.5	2.25	2	2	2.5	2.75	2.25	2.5

**BSc Microbiology Syllabus (w.e.f:2020-2021A.B)**

	<b>Government College (Autonomous) Rajahmundry</b>	<b>Program &amp; Semester</b> III B.Sc. MZC, FMZC (V Semester)			
Course Code MBY-145 B2	<b>TITLE OF THE COURSE</b> <b>BIOSTATISTICS AND BIOINFORMATICS</b>				
Teaching	Hours Allocated: 60 ( <b>Theory</b> )	L	T	P	C
Pre-requisites	Introductory microbiology	3	1	-	3

**Aim and objectives of Course**

To understand Biostatistics and Bioinformatics

**Learning outcomes of Course**

Up on completion of the course students able to

**CO1:** Understand biological data bases

**CO2:** Summarize Searching sequence data bases

**CO3:** Students able to use appropriate tests for bio variable analysis

**CO4:** Able to understand analytical tests and Construction of phylogenetic trees by clustering methods

**CO5:** Able to understand protein modelling methods

**UNIT – I****No. of hours: 7**

Definition, nature and scope of bioinformatics. Bioinformatics versus computational biology. Branches of bioinformatics. Basic concepts in bioinformatics. Introduction to Biological data bases: NCBI, EMBL, EXPASY, PIR, Pfam. Concept of World Wide Web: HTML, HTTP.

**UNIT – II****No. of hours: 7**

Searching sequence data bases using BLAST. Multiple sequence alignment– progressive alignment–profiles–multi dimensional dynamic programming. Biostatistics: Measures of Central tendency and distribution–mean, median, mode, range, standard deviation, variance.

**UNIT – III****No. of hours: 7**

Basic principles of probability theory, Bayes theorem, Normal distribution, statistical inference –Types of errors and levels of significance. Comparison of variance (F-test), small sample test, t-test for comparison of means, chi square test. Analysis of variance–one way and two way, multiple comprises.

**UNIT – IV****No. of hours: 7**

Correlation and Linear regression. Sequence Analysis: Introduction to hidden Markov models. Genomics and proteomics: Molecular phylogenetics: Construction of Phylogenetic trees using parsimony method and branch & bound method. Clustering methods– UPGMA & neighbour-joining. Fragment assembly, peptide sequencing using mass and spectroscopy data. Comparative genomics.

**UNIT – V****No. of hours: 8**

Modelling: Protein secondary structure prediction–Chou Fasmanrules– Neural networks–discriminate analysis. Prediction of transmembrane segments in Membrane proteins. Protein3D structure prediction– homology– threading – Potential energy functions–energy minimization–molecular dynamics–simulated annealing.

**TEXT & REFERENCE BOOKS**

1. Daniel, 2006, Biostatistics, Eighth Edition. John Wiley and sons.
2. Durbin, Eddy, Krogh, Mithison, Biological sequence analysis.
3. T.A.AttwoodandD.J.parry-smith, 2001, Introduction of Bioinformatics.
4. A.D.Baxevaris,1998, Bioinformatics:Apracticalguidetotheanalysisof Genes and proteins,(Edited) B.F.Publication.
5. David W, 2005, Bio-informatics;sequenceandGenomeAnalysis,2ndEdition By Mount CB Spublishers.

### III B.Sc Microbiology ,Semester -V

#### Blue Print B2- PAIR -BIOSTATISTICS AND BIOINFORMATICS

Section		Unit-I	Unit-II	Unit-III	Unit-IV	Unit-V	Total questions	No of questions answered	Marks allotted
<b>A</b>	Essay Questions	2	2	2	1	1	8	4	10x4 = 40
<b>B</b>	Short questions	2	2	2	2	2	10	5	2X5=10

**Total Marks= 50**

#### Microbiology Model Question Paper (Theory)

TIME: 2 1/2 HOURS

Maximum Marks: 50

#### Section- A

**Answer any FIVE question**

**4×10=40 Marks**

1. a) Essay question from unit I.  
(or)  
b). Essay question from unit I
2. a) Essay question from unit II  
Or  
b) Essay question from unit II
3. a) Essay question from unit III  
(or)  
b). Essay question from unit III
4. a) Essay question from unit IV  
(or)  
b). Essay question from unit V

#### Section-B

**Answer any FIVE questions only**

**5×2=10Marks**

- 5.Short question from unit I
- 6.Short question from unit I
- 7.Short question from unit II
- 8.Short question from unit II
- 9.Short question from unit III
- 10.Short question from unit III
- 11.Short question from unit IV
- 12.Short question from unit IV
- 13.Short question from unit V
- 14 Short question from unit V

**Microbiology Model Question Paper (Theory)**

**MBY-140 BIOSTATISTICS AND BIOINFORMATICS**

**Paper: II SEMESTER –IV**

**Time: 2 1/2Hrs**

**Max.Marks:50**

**Part-A**

**Note: Answer ALL questions**

1.a) Write a note on definition, nature and scope of bioinformatics.

**OR**

b) Explain bioinformatics versus computational biology.

2. a) Explain searching sequence data using BLAST

**OR**

b) Write a note on multiple sequence alignment

3. a) Write a note on basic principles of probability theory

**OR**

b) Explain comparison of variance, small sample test, T-Test and Chisquare test.

4. a) Explain peptide sequencing using mass and spectroscopy data

**OR**

b) Write a note on protein 3D structure prediction.

**Part-B**

Answer any five questions. All carry equal marks.

5. NCBI

10. Analysis of variance

6. World wide web

11. Markov models

7. BLAST

12. UPGMA

8. Standard deviations

13. Protein secondary structure prediction

9. Types of errors

14. Simulated annealing

**Web links**

<https://ccelms.ap.gov.in/rusa/user/gtitles/122>

<https://www.scienceprofonline.com/virtual-micro-main.html>

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CO2	3	2	3	3	2	3	3	1	3	3	3	2	3
CO3	3	3	3	3	2	2	2	2	2	3	3	2	2
CO4	3	2	2	2	2	2	3	3	1	1	2	2	2
Avg.	2.75	2.5	2.5	2.75	2.25	2.5	2.25	2	2	2.5	2.75	2.25	2.5

**MBP B2 - BIOSTATISTICS AND BIOINFORMATICS**

	<b>Government College (Autonomous) Rajahmundry</b>	<b>Program &amp; Semester</b>			
Course Code MBY 145P B2	<b>TITLE OF THE COURSE</b>  <b>BIOSTATISTICS AND BIOINFORMATICS</b>	III B.Sc. MZC & FMZC (V Semester)			
Teaching	Hours Allocated: 30 ( <b>Practical</b> )	L	T	P	C
Pre-requisites	Basic Microbiology	-	-	2	2

**TOTAL HOURS: 36****CREDITS: 2**

1. Isolation of plasmid DNA from *E.coli* cells
2. Quantitative and qualitative analysis of proteins / DNA by using spectrophotometer.
3. Demonstration of Southern hybridization
4. Demonstration of amplification DNA by PCR.
5. Use of software for sequence analysis of nucleotides and proteins.
6. Problem related to t – test and  $\chi^2$  test.
7. Use of Internet/software for sequence analysis of nucleotides and proteins:
8. Studies of public domain data bases for nucleic acid and protein sequences.
9. Determination of protein structure (PDB).
10. Genome sequence analysis
11. Problems related to measures of central tendency, dispersion, t-test and chi Square test.

**SUGGESTED READINGS:**

1. Daniel, 2006, Biostatistics, Eighth Edition. John Wisley and sons.
2. Durbin, Eddy, Krogh, Mithison, Biological sequence analysis.
3. T.A.Attwood and D.J. parry-smith, 2001, Introduction of Bioinformatics.
4. A.D.Baxevaris, 1998, Bioinformatics: A practical guide to the analysis of Genes and proteins, (Edited) B.F. Publication.
5. David W, 2005, Bio-informatics; sequence and Genome Analysis, 2nd Edition By Mount CB Spublishers.

**Web links**

<https://vlab.amrita.edu/?sub=3&brch=73>

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	2	3	3	3	1	2	2	3	3	3	3
CO2	3	2	3	3	2	3	3	1	3	3	3	2	3
CO3	3	3	3	3	2	2	2	2	2	3	3	2	2
CO4	3	2	2	2	2	2	3	3	1	1	2	2	2
Avg.	2.75	2.5	2.5	2.75	2.25	2.5	2.25	2	2	2.5	2.75	2.25	2.5

	<b>Government College (Autonomous) Rajahmundry</b>	<b>Program &amp; Semester</b> III B.Sc. MZC, FMZC (V Semester)			
Course Code MBY-145 C1	<b>TITLE OF THE COURSE</b> <b>MICROBIAL QUALITY CONTROL, INSTRUMENTATION AND TECHNIQUES</b>				
Teaching	Hours Allocated: 60 ( <b>Theory</b> )	L	T	P	C
Pre-requisites	Introductory microbiology	3	1	-	3

**Aim and objectives of Course**

To study quality control in food and pharmaceutical industries and analytical techniques

**Learning outcomes of Course**

Up on completion of the course students able to

**CO1:** Develop skills on disinfection of instruments and equipment's in laboratory and Hospitals and documentation

**CO2:** To understand the working principle of basic laboratory equipments

**CO3:** To understand the techniques like MPN and direct microscopic methods

**CO4:** To understand and demonstrate Principles of Microscopy, handling and uses of microscopes

**CO5:** To understand and demonstrate the various analytical and separation techniques

**UNIT – I****No. of hours: 7**

Microbial quality control definition, history and introduction. Standard Methods involved in assessment of microbial quality control. Q.A and Q.C definitions and importance. Traditional Microbiological Quality Controlling methods: Sampling methods, TVC, APC and serial dilution techniques. Microbiological criteria. Laboratory facility design for quality control: Sterilization, disinfection and decontamination. Personnel training: Hygiene and handling techniques. Documentation. Good laboratory practices.

**UNIT – II****No. of hours: 8**

Culture media used in QC and QA: Design of specialized media for identification of pathogens. Good laboratory practices in culture media preparation: raw material, water, pH. Uses of media.

Selective and indicator media used in pharmaceutical and food industries. Instruments associated in QC and QA: Principle involved, working conditions, uses and precautions of Laminar Air Flow (LAF), Autoclave, Incubator, pH meter, Colony counter, Hot air oven, Centrifuges and storage devices.

**UNIT – III****No. of hours: 7**

Techniques for enumeration of microorganisms: sample preparation from Aqueous, soluble, insoluble, medical and pasteurized materials. Counting methods: pour plate, spread plate, membrane filtration. Most Probable Number (MPN) and MIC. Turbidimetric methods. Staining techniques for identification bacteria and Fungi.

**UNIT – IV****No. of hours: 7**

Microscopy – Principles of light, phase, fluorescent & electron microscopes; Microscopic techniques: Basic principles and applications of phase – contrast microscopy, fluorescent microscopy and electron microscopy, types of electron microscopy– scanning and transmission. Radio isotopes: radiometric analysis, stable and radioactive isotopes, preparation, labelling, detection and measurement of isotope.

### **UNIT - V**

**No. of hours: 7**

Principles of Centrifugation – Centrifugation techniques – preparative and analytical methods, density gradient centrifugation. General principles and applications of chromatography – Paper, Column, Thin layer, Gas, Ion exchange, Affinity chromatography, HPLC, FPLC, GCMS and Gel filtration. Electrophoresis- moving boundary, zone (Paper Gel) electrophoresis. Immuno electrophoresis. Immunoblotting. Isoelectric focusing, 2-Delectrophoresis, Principles of colorimetry

### **TEXT & REFERENCE BOOKS**

1. Hand book of Microbial Quality control by Rosamund. M, Baird Norman. A, Hodges and Stephen. P, Denyer. CRC press.
2. The Microbiological Quality of Food, 1st Edition, Editors: Antonio Bevilacqua Maria Rosaria Corbo Milena SinigagliaeBook ISBN: 9780081005033 Imprint:Wood head Publishing.
3. Guide to Microbiological Control in Pharmaceuticals and Medical Devices, Second Edition, Stephen P. Denyer, Rosamund M. Baird, CRC Press.
4. WILSON & WALKER, Practical Biochemistry: Principles and techniques, Academic publishers.
5. UPADHYAY, UPADHYAY &NATH, Biophysical Chemistry: Principles and techniques, Himalaya Publishers.

### III B.Sc Microbiology ,Semester -V

#### Blue Print for C1- PAIR : Microbial Quality Control, Instrumentation & Techniques

Section		Unit-I	Unit-II	Unit-III	Unit-IV	Unit-V	Total questions	No of questions answered	Marks allotted
<b>A</b>	Essay Questions	2	2	2	1	1	8	4	10x4 = 40
<b>B</b>	Short questions	2	2	2	2	2	10	5	2X5=10

**Total Marks= 50**

#### Microbiology Model Question Paper (Theory)

TIME: 2 1/2 HOURS

Maximum Marks: 50

#### Section- A

**Answer any FIVE question**

**4×10=40 Marks**

1. a) Essay question from unit I.  
(or)  
b). Essay question from unit I
2. a) Essay question from unit II  
Or  
b) Essay question from unit II
3. a) Essay question from unit III  
(or)  
b). Essay question from unit III
4. a) Essay question from unit IV  
(or)  
b). Essay question from unit V

#### Section-B

**Answer any FIVE questions only**

**5×2=10Marks**

- 5.Short question from unit I
- 6.Short question from unit I
- 7.Short question from unit II
- 8.Short question from unit II
- 9.Short question from unit III
- 10.Short question from unit III
- 11.Short question from unit IV
- 12.Short question from unit IV
- 13.Short question from unit V
- 14 Short question from unit V

**Microbiology Model Question Paper (Theory)**

**MBY-140 MICROBIAL QUALITY CONTROL, INSTRUMENTATION AND  
TECHNIQUES**

**Paper: II SEMESTER –IV**

**Time: 2 1/2Hrs**

**Max.Marks:50**

**Part-A**

**Note: Answer ALL questions**

1.a) Write a note on traditional microbiological quality controlling methods.

**OR**

b) Write a note on personal training, hygiene and handling techniques.

2. a) explain selective and indicator media used in pharmaceutical and food industries.

**OR**

b) Explain instruments associated in quality analysis and quality control.

3. a) Write a note on techniques for enumeration of microorganisms.

**OR**

b) Briefly explain staining techniques for identification of bacteria

4. a) Explain the basic principle and application of phase contrast microscopy.

**OR**

b) Explain the use of affinity chromatography.

**Part-B**

**Answer any five questions. All carry equal marks.**

5. TVC

10. MIC

6. Serial dilution techniques

11. SEM

7. Autoclave

12. Radio isotopes

8. Hot air oven

13. Centrifuge

9. MPN

14. Calorimetry

**Web links**

<https://ccelms.ap.gov.in/rusa/user/gtitles/122>

<https://www.scienceprofonline.com/virtual-micro-main.html>

<https://slidetodoc.com/history-of-microbiology-from-the-virtual-microbiology-classroom/>

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CO2	3	2	3	3	2	3	3	1	3	3	3	2	3
CO3	3	3	3	3	2	2	2	2	2	3	3	2	2
CO4	3	2	2	2	2	2	3	3	1	1	2	2	2
Avg.	2.75	2.5	2.5	2.75	2.25	2.5	2.25	2	2	2.5	2.75	2.25	2.5

**MBP-C1: MICROBIAL INSTRUMENTATION AND BIOTECHNIQUES**

	<b>Government College (Autonomous) Rajahmundry</b>	<b>Program &amp; Semester</b>			
Course Code MBY 145P CI	<b>TITLE OF THE COURSE</b>  <b>MICROBIAL QUALITY CONTROL, INSTRUMENTATION AND TECHNIQUES</b>	III B.Sc. MZC & FMZC ( V Semester)			
Teaching	Hours Allocated: 30 ( <b>Practical</b> )	L	T	P	C
Pre-requisites	Basic Microbiology	-	-	2	2

1. Isolation and enumeration of bacteria from food / pharmaceutical source.
2. Quality Assurance of water by MPN method.
3. Preparation of any two selective and indicator media commonly used Q.A & Q.C
4. Microbial quality of in and around laboratory conditions.
5. Isolation and Identification of fungi by using selective media and staining procedures.
6. Identification of MIC of any one antibiotic.
7. Colorimetric and spectroscopic estimation of nucleic acids.
8. Microscopic observations of examination of bacteria, fungi and actinomycetes.
9. Separation of cell components by centrifugation technique.
10. Demonstration of immune electrophoresis.
11. Demonstration of HPLC.

**Suggested readings:**

6. Hand book of Microbial Quality control by Rosamund. M, Baird Norman. A, Hodges and Stephen. P, Denyer. CRC press.
7. The Microbiological Quality of Food, 1st Edition, Editors: Antonio Bevilacqua Maria Rosaria Corbo Milena SinigagliaeBook ISBN: 9780081005033 Imprint:Wood head Publishing.
8. Guide to Microbiological Control in Pharmaceuticals and Medical Devices, Second Edition, Stephen P. Denyer, Rosamund M. Baird, CRC Press.
9. WILSON & WALKER, Practical Biochemistry: Principles and techniques, Academic publishers.
10. UPADHYAY, UPADHYAY &NATH, Biophysical Chemistry: Principles and techniques, Himalaya Publishers.

**Web links**

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CO3	3	3	3	3	2	2	2	2	2	3	3	2	2
CO4	3	2	2	2	2	2	3	3	1	1	2	2	2
Avg.	2.75	2.5	2.5	2.75	2.25	2.5	2.25	2	2	2.5	2.75	2.25	2.5

	<b>Government College (Autonomous) Rajahmundry</b>	<b>Program &amp; Semester</b> III B.Sc. MZC, FMZC (V Semester)			
Course Code MBY-145 C2	<b>TITLE OF THE COURSE</b> <b>DRUG DESIGN, DISCOVERY AND INTELLECTUAL PROPERTY RIGHTS (IPR)</b>				
Teaching	Hours Allocated: 60 ( <b>Theory</b> )	L	T	P	C
Pre-requisites	Introductory microbiology	3	1	-	3

**Aim and objectives of Course**

To study drug design, discovery and IPR

**Learning outcomes of Course**

Up on completion of the course students able to

**CO1:**Students should be able to understand approaches for drug design, sources of drugs and molecular mechanism of drugs

**CO2:**Students should be able to understand drug development process

**CO3:**Get knowledge on vaccines, gene therapy and gene based vaccines

**CO4:**Students will get knowledge on outlines of intellectual property rights, ISI and Bio standards

**CO5:**Students will understand concepts Bio safety and ethics

**Unit – I****No. of Hours: 7**

Introduction- History of drug design, Current approaches and philosophies in drug design, Molecular mechanisms of diseases and drug action with examples. Pharmaceutical products of microbial origin (antibiotics) animal origin (sex hormones), plant origin (Alkaloids & Morphine). Sources of Drugs- Microbial drugs, Plants as a source of drugs, *E. coli* as a source of recombinant therapeutic proteins.

**Unit – II****No. of Hours: 7**

Expression of recombinant proteins in yeasts, animal cell culture systems. Rational drug design and Combinatorial approaches to drug discovery. Drug development process- Impact of genomics and related technologies upon drug discovery: Gene chips, Proteomics, Structural genomics and Pharmacogenetics. Drug manufacturing process- Guides to good manufacturing practice.

**Unit – III****No. of Hours: 7**

Vaccines and adjuvant- Traditional vaccine preparations, Attenuated and inactivated viral and bacterial vaccines, Toxoids. Peptide vaccines. Adjuvant technology. Nucleic acid as drugs- Gene therapy: Basic approach to gene therapy, Vectors used in gene therapy - Manufacture of viral vectors, Non-viral vectors. Gene therapy and genetic disease, cancer, Gene therapy and AIDS. Gene based vaccines.

**Unit – IV****No. of Hours: 8**

Introduction: general introduction to IPR (parent, plant breeder's right). Trademarks, industrial design, trade secrets (or) undisclosed information integrated circuit designs.

Patenting principle, international – standards and patent validity (neem and relaxins), recent developments in patent system and patentability of biotechnology, invention IPR issues of the Indian context. Copy right and rights related to copy right, International standards as per WHO, ISI, bio safety and validation.

**Unit – V****No. of Hours: 7**

Biotechnology and hunger: challenges for the Indian biotechnological research and industries. Bio safety: the Cartagena protocol on bio safety.

Bio safety management: key to the environmentally responsible use of biotechnology, ethical implications of biotechnology product techniques, social and ethical implications of biological weapons

**TEXT & REFERENCE BOOKS**

1. W.B.Hugo & A.D.Russell, Pharmaceutical Microbiology edited, 6th Edition, Black Well science.
2. Shanson D.C., Microbiology in clinical practice, 2<sup>nd</sup> edition, London; Wright.
3. T.Sammes Ellis Horwood, opicin Antibiotic chemistry Vol I to V.
4. Wulf Crueger, Biotechnology – A text book of Industrial Microbiology, 2<sup>nd</sup> Edition, Panima publishers
5. A.H.Patel, 1984, Industrial Microbiology, Macmilan India Limited.
6. Coulson C.J., London; Taylor and Francis, Molecular mechanisms of drug action.
7. Denyes S.P. & Baird R.M. Chichester, Ellis Horwood, Guide to microbiological Control in Pharmaceuticals.
8. Murray S. Cooper, Quality control in the Pharmaceutical Industry-Edt., Vol-II, Academic press, New York.
9. Sydney H. Willin, Murray M. Tuckerman, William S. Hitchings IV, Good Manufacturing practices of pharmaceuticals, second Edt., Merceel Dekker NC Nework.

### III B.Sc Microbiology ,Semester -V

#### Blue Print for C 2 - PAIR: C -Drug Design, Discovery & Intellectual Property Rights (IPR)

Section		Unit-I	Unit-II	Unit-III	Unit-IV	Unit-V	Total questions	No of questions answered	Marks allotted
<b>A</b>	Essay Questions	2	2	2	1	1	8	4	10x4 = 40
<b>B</b>	Short questions	2	2	2	2	2	10	5	2X5=10

**Total Marks= 50**

#### Microbiology Model Question Paper (Theory)

TIME: 2 1/2 HOURS

Maximum Marks: 50

#### Section- A

**Answer any FIVE question**

**4×10=40 Marks**

1. a) Essay question from unit I.  
(or)  
b). Essay question from unit I
2. a) Essay question from unit II  
Or  
b) Essay question from unit II
3. a) Essay question from unit III  
(or)  
b). Essay question from unit III
4. a) Essay question from unit IV  
(or)  
b). Essay question from unit V

#### Section-B

**Answer any FIVE questions only**

**5×2=10Marks**

- 5.Short question from unit I
- 6.Short question from unit I
- 7.Short question from unit II
- 8.Short question from unit II
- 9.Short question from unit III
- 10.Short question from unit III
- 11.Short question from unit IV
- 12.Short question from unit IV
- 13.Short question from unit V
- 14 Short question from unit V

**Microbiology Model Question Paper (Theory)**

**MBY-140 MICROBIAL QUALITY CONTROL, INSTRUMENTATION AND  
TECHNIQUES**

**Paper: II SEMESTER –IV**

**Time: 2 1/2Hrs**

**Max.Marks:50**

**Part-A**

**Note: Answer ALL questions**

1. a) Write a note on history, current approaches and philosophies in drug design

**OR**

b) Write a note on pharmaceutical products of microbial origin.

2. a) Explain rational drug design and combinatorial approaches to drug discovery

**OR**

b) Explain drug development process in brief

3. a) Write a note on traditional vaccine preparation

**OR**

b) Briefly explain basic approach to gene therapy

4. a) Write a note on recent developments in patent system and patentability of biotechnology.

**OR**

b) Write a note on biosft with special reference to the Cartagena protocol on biosafety.

**Part-B**

**Answer any five questions. All carry equal marks.**

5. Alkaloids and morphine

10. Trade marks

6. E. Coli as a source of recombinant protein

11. Bio-ethics

7. Toxoids

12. Bio-weapons

8. Gene based vaccines

13. Gene chips

9. Copy rights

14. Proteomics

**Web links**

<https://ccelms.ap.gov.in/rusa/user/gtitles/122>

<https://www.scienceprofonline.com/virtual-micro-main.html>

<https://slidetodoc.com/history-of-microbiology-from-the-virtual-microbiology-classroom/>

<https://studylib.net/doc/5795921/microbial-growth-lecture-powerpoint>

<https://youtube.com/channel/UCAXheRahnkShRUKSRbbihuQ>

**CO-PO Mapping**


(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], '-': No correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	2	3	3	3	1	2	2	3	3	3	3
CO2	3	2	3	3	2	3	3	1	3	3	3	2	3
CO3	3	3	3	3	2	2	2	2	2	3	3	2	2
CO4	3	2	2	2	2	2	3	3	1	1	2	2	2
Avg.	2.75	2.5	2.5	2.75	2.25	2.5	2.25	2	2	2.5	2.75	2.25	2.5

**MBP – C2: DRUG DESIGN, DISCOVERY AND INTELECTUAL PROPERTY RIGHTS (IPR)**

**TOTALHOURS:40**

**CREDITS: 3**

	<b>Government College (Autonomous) Rajahmundry</b>	<b>Program &amp; Semester</b>			
Course Code MBY 145P C2	<b>TITLE OF THE COURSE</b> <b>DRUG DESIGN, DISCOVERY AND INTELECTUAL PROPERTY RIGHTS (IPR)</b>	III B.Sc. MZC & FMZC (V Semester)			
Teaching	Hours Allocated: 30 ( <b>Practical</b> )	L	T	P	C
Pre-requisites	Basic Microbiology	-	-	2	2

1. Isolation of antibiotic producing bacteria from soil samples
2. Isolation of drug resistant plasmid from bacteria (E.coli).
3. Isolation of Actinomycetes from soil.
4. Identification of antibacterial activity of actinomycetes.
5. Identification of antibacterial activity of fungi
6. Identification of antagonistic activity of any two fungal species.
7. Assay of any one antibiotic (Penicillin).
8. Determination of MIC of any one antibiotic (penicillin / streptomycin).
9. Study of components and design of a BSL – III laboratory
10. Filing applications for approval from bio safety committee
11. Filing primary applications for patents
12. Study of steps of patenting process
13. A case study of patent.
14. Study of bio safety measures in pharmaceutical industry.
15. Study on QA & QC parameters followed in R&D laboratory.

**SUGGESTED READINGS:**

1. W.B.Hugo & A.D.Russell, Pharmaceutical Microbiology edited, 6th Edition, Black Well science.
2. Shanson D.C., Microbiology in clinical practice, 2<sup>nd</sup> edition, London; Wright.
3. T.Sammes Ellis Horwood, opicin Antibiotic chemistry Vol I to V.
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9. Sydney H. Willin, Murray M. Tuckerman, William S. Hitchings IV, Good Manufacturing practices of pharmaceuticals, second Edt., Merce Dekker NC Nework.

**Web links**

<https://vlab.amrita.edu/?sub=3&brch=73>

<https://learn.chm.msu.edu/vibl/>

<https://www.labster.com/microbiology-virtual-labs/>

<https://www.scienceprofonline.org/vmc/microbiology-laboratory-course-teaching-materials.html>

<https://virtuallabs.nmsu.edu/>

<https://www.merlot.org/merlot/viewMaterial.htm?id=79694>

**CO-PO Mapping**

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	2	3	3	3	1	2	2	3	3	3	3
CO2	3	2	3	3	2	3	3	1	3	3	3	2	3
CO3	3	3	3	3	2	2	2	2	2	3	3	2	2
CO4	3	2	2	2	2	2	3	3	1	1	2	2	2
Avg.	2.75	2.5	2.5	2.75	2.25	2.5	2.25	2	2	2.5	2.75	2.25	2.5

### Practical Examination pattern for Semester End Examinations

Practical examination in Department of MICROBIOLOGY is held before end of semester exams twice in a year to test practical skills among the students.

Total marks allotted for practical are **50** marks two hours in each semester

The division of marks is as follows

Section		Unit-I	Unit-II	Unit-III	Unit-IV	Unit-V	Total questions	No of questions answered	Marks allotted
<b>A</b>	Essay Questions	2	2	2	1	1	8	4	10x4 = 40
<b>B</b>	Short questions	2	2	2	2	2	10	5	2X5=10