

# DEPARTMENT OF MICROBIOLOGY

## COURSE CURRICULUM & MARKING SCHEME

# M.Sc. MICROBIOLOGY

## Semester - III

SESSION : 2024-25



ESTD: 1958

## GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG, 491001 (C.G.)

(Former Name – Govt. Arts & Science College, Durg)

NAAC Accredited Grade A<sup>+</sup>, College with CPE - Phase III (UGC), STAR COLLEGE (DBT)

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**DEPARTMENT OF MICROBIOLOGY**  
**GOVT. V. Y. T. P.G. AUTONOMOUS COLLEGE DURG**  
**SYALLABUS AND MARKING SCHEME**

**THIRD SEMESTER**

**Session: 2024-2025**

Paper No.	Title of the Paper	Marks Allotted in Theory		Marks Allotted in Internal Assessment		Credits
		Max	Min	Max.	Min.	
I	MMB301 BIOPHYSICAL TECHNIQUE, INSTRUMENTATION AND BIOINFORMATICS	80	16	20	04	05
II	MEDICAL MICROBIOLOGY	80	16	20	04	05
IIIA	FOOD AND DAIRY MICROBIOLOGY (Elective)	80	16	20	04	05
IIIB	AGRICULTURE MICROBIOLOGY (Elective)	80	16	29	04	05
V	LAB COURSE I Based on Paper I	100	33	-	-	04
IV	LAB COURSE II Based on Paper II & III	100	33	-	-	04
	<b>Total</b>	<b>440</b>	<b>-</b>	<b>60</b>	<b>-</b>	<b>23</b>

**Name and Signatures**

<p>Chairperson/ HOD- Dr. Pragya Kulkarni </p> <p>Subject Expert - Dr. Anita Mahiswar </p> <p>Subject Expert - Dr. Sonal Mishra </p> <p>VC Nominee – Dr. Prakash Saluja</p> <p>Industrial Representative- Shri Amitesh Mishra </p> <p>Member of Other Department- Dr. Ranjana Shrivastava</p>	<p>Student Nominee – Ms. Yogita Lokhande </p> <p>Departmental members</p> <ol style="list-style-type: none"> <li>Mrs. Rekha Gupta </li> <li>Mrs. Neetu Das </li> <li>Ms. Anamika Sharma </li> <li>Ms. Mrinalini Soni </li> <li>Ms. Neetu Bhargav </li> </ol>
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Session : 2024 - 25  
M.Sc. – MICROBIOLOGY  
SEMESTER III  
PAPER – I

MMB 301 BIOPHYSICAL TECHNIQUES, INSTRUMENTATION AND BIOINFORMATICS

Max.M. – 80; Min. M. – 16

Upon successful completion of the course students will be able –

- ❖ To gain the skill to deal with microscope, different separation techniques used for isolation and purification of bio molecules
- ❖ To enable the mechanism of radioactive detection, measurement and applications in biological experiments
- ❖ To study the origin, importance and applications of techniques like spectroscopy, NMR, ESR and PCR
- ❖ To understand the concept of Bioinformatics, know the forms of biological information and learn the available resources and tools

Unit – I

- Microscopy–Phase contrast, Fluorescence microscopy
- Electron microscopy-Transmission and scanning electron microscopes (TEM & SEM)
- Centrifugation techniques: Basic principles of centrifugation, Standard sedimentation coefficient and measurement of sedimentation co-efficient, Analytical and preparative centrifugation
- Differential, rate zonal and equilibrium density gradient centrifugation

Unit – II

- Principle & application of Chromatography: General principles. Types- partition, adsorption; paper, thin layer, column chromatography, HPLC, GLC, gel filtration, ion exchange chromatography and affinity chromatography
- Principle & application of Electrophoresis: General principles, Types – paper electrophoresis, cellulose acetate, starch gel electrophoresis, polyacrylamide gel electrophoresis and Agarose gel electrophoresis, Horizontal and vertical electrophoresis, Two-dimensional electrophoresis, Immune electrophoresis
- Blotting techniques -Southern, Northern and Western blotting
- PCR – Mechanism of working & types

Unit – III

- Electromagnetic spectrum and Instrumentation: measuring the absorption and application of UV- visible spectrophotometer, Spectroscopic techniques- Principle, simple theory of absorption of light by molecules, Fluorescence spectroscopic, NMR, ESR and Mossbauer spectroscopic method
- Radio isotopic techniques: Principle, Radioactive isotopes, radioactive decay, Detection and measurement of radioactivity, Geiger-Muller counter, scintillation counter, Autoradiography, tracer techniques and applications, commonly used isotopes in biology, Labeling procedures and safety aspects.

Unit– IV

- Concept of Bioinformatics: Aim and branches, Applications, Role of internet
- Basic biomolecular concepts: Protein, Amino acids, DNA, RNA sequences, structure and functions, Forms of biological information
- Bioinformatics resources: NCBI, EBI, ExPASy, RCSB, DDBJ, available tools
- Open access bibliographic resources and literature data bases: PubMed, BioMed Central, Public Library of Science (PloS), CiteXplore

Name and Signatures:

Chairperson/ HOD

Subject Expert

Subject Expert

VC Nominee

Industrial Representative

Member of Other Department

Student Nominee

Departmental members:









### **Recommended Books:**

1. Biophysical Chemistry, Principles and Techniques – Upadhyay and Upadhyay, Himalaya Pub.
2. Instrumental Analysis – Skoog and Haller
3. Analytical Chemistry – G. Chatwal and Anand, Himalaya Pub.
4. Biotechniques: Theory and Practice – S.V.S. Rana, Rastogi Pub.
5. Practical Biochemistry- Principles And Techniques- Keith Wilson And John Walker
6. Bioinformatics: Databases, Tools and Algorithms, by OrpitaBosu, Simminder Kaur Thukral, OXFORD University Press.
7. Bioinformatics: Sequence and Genome Analysis by D.W. Mount , second edition, Cold Spring Harbor Laboratory Press
8. Bioinformatics : Methods and Application by S.C. Rastogi, N. Mendira, P. Rastogi, Third edition , PHI Learning Private Limited
9. Introduction to Bioinformatics by Teresa. K. Attwood and David J. Parry- Smith, Low Price edition, Pearson Education

**Session: 2024 - 25**  
**M.Sc. – MICROBIOLOGY**  
**SEMESTER III**  
**PAPER – II**  
**MMB 302 MEDICAL MICROBIOLOGY**

**Max. M.- 80; Min. M. – 16**

**Upon successful completion of the course students will be able –**

- ❖ **To get an overview of discovery and development of medical microbiology and contributions of pioneers in the field of medical microbiology**
- ❖ **To understand the basic principles of medical microbiology and study the classification of different disease-causing agents and infectious diseases**
- ❖ **To learn the diagnostic skills for infectious diseases**
- ❖ **To recognize the measures taken for control of diseases through different systems**

**Unit – I**

- Early discovery of pathogenic microorganisms: Development of bacteriology as scientific discipline, Contributions made by eminent scientists
- Normal microbial flora of human body; Role of the resident flora
- Establishment, spreading, tissue damage & anti-phagocytic factors: Mechanism of bacterial adhesion
- Colonization & invasion of mucous membranes of respiratory, enteric & urogenital tracts
- Role of aggressins, Depolymerising enzymes, Organotropisms, Variation & virulence
- Four lines of defense mechanism

**Unit – II**

- Classification of pathogenic bacteria: Staphylococcus, Streptococcus, Pneumococcus, Neisseria, Cornebacterium, Bacillus, Clostridium, Non-sporing Anaerobes, Organisms belonging to Enterobacteriace, Vibrios
- Non fermenting gram negative bacilli, Yersinia, Haemophilus, Bordetella, Brucella, Mycobacteria, Spirochaetes, Actinomycetes, Rickettsiae, Chlamydiae

**Unit – III**

- Viruses host interactions: pox viruses, herpes virus, adeno viruses, picarbo viruses, orthomyxo viruses, paramyxo viruses, arbo viruses, rhabdo viruses, hepatitis viruses, oncogenic viruses, human immuno deficiency viruses (AIDS)
- Fungal infections: Dermatophytes, dimorphic fungi, opportunistic fungal pathogens, their description, classification and laboratory diagnosis; Fungal Diseases: Mycoses systemic and subcutaneous, Pneumocystis, Blastomycoses, Dermatophytosis, Aspergilosis
- Protozoal diseases: Leishmania, Trypanosoma

**Unit –IV**

- Laboratory control: antimicrobial therapy, Various methods of drug susceptibility testing, Antibiotic assay in body fluids
- Brief account on available vaccines and schedules, passive prophylactic measures
- Nosocomial infection: common types of hospital infections, their diagnosis and control

**Name and Signatures:**

  
**Chairperson/ HOD**

  
**Subject Expert**

  
**Subject Expert**

**VC Nominee**

**Industrial Representative**

  
**Member of Other Department**

  
**Student Nominee**

**Departmental members:**









### **Recommended Books:**

1. Text book of Microbiology – R. Ananthanarayanan and C. K. JayaramPanicker, orient Longman, 1997.
2. Medical Microbiology – Mackie and MaCartney,
  1. Microbial Infection Vol. 1:.
  2. Practical Medical Microbiology. Vol 2– Churchill Livingstone, 1996.
3. Microbiology in clinical Practice – D.C. Shanson, Wright PSG, 1982.
4. Bailey and Scott's Diagnostic Microbiology – Baron EJ, Peterson LR and Finegold SM Mosby, 1990.



Session: 2024 - 25

M.Sc. – MICROBIOLOGY

SEMESTER III

PAPER – III A (Elective)

MMB 303A FOOD AND DAIRY MICROBIOLOGY

Max. M. – 80; Min. M. – 16

Upon successful completion of the course students will be able –

- ❖ To understand the idea microorganisms associated with food and factor for their growth
- ❖ To be acquainted with the principles of food preservation, food spoilage and food born infections
- ❖ To know the measures taken for food quality control
- ❖ To get an overview of various food types prepared as of microbial fermentation

**Unit – I**

- Food as substrate for microorganisms: Important micro organisms in food microbiology - Molds, Yeasts and Bacteria (General characteristics and importance)
- Principles of food preservation: Asepsis (anaerobic conditions, high temperatures, low temperature, drying)
- Factors influencing microbial growth in food: Extrinsic & intrinsic factors; Chemical preservatives and food additives, Canning, processing for Heat treatment - D, Z, and F values and working out treatment parameters.

**Unit – II**

- Contamination and Spoilage: Principle, Cereals, sugar products, vegetables, fruits, meat and meat products, Milk and Milk products, Fish & sea foods, poultry-spoilage of canned foods. Detection of spoilage and characterization.
- Food-borne infections and intoxications: Bacterial and nonbacterial with examples of infective and toxic types (Brucella, Bacillus, Clostridium, Escherichia, Salmonella, Shigella, Staphylococcus, Vibrio, Yesinia; Nematodes, Protozoa , algae , fungi and viruses),
- Food borne out breaks: laboratory testing procedures, Prevention Measures Food sanitation in manufacture and retail trade, Food control agencies and its regulations
- Plant sanitation: Employee's Health standards-waste treatment-disposal-quality control.

**Unit –III**

- Food fermentations: bread, cheese, vinegar, fermented vegetables, fermented dairy products
- Experimental and industrial production methods of fermented food products
- Spoilage and defects of fermented dairy products
- Oriental Fermented foods, their quality standards and control

**Unit – IV**

- Food Produced by Microbes: Fermented foods, microbial cells as food (single cell proteins)
- Bioconversions: Production of alcohol, Fermented beverages (beer and wine), Steroid conversions
- Industrial Enzymes productions; Genetically modified foods; Mushroom cultivation

Name and Signatures:

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Subject Expert

Subject Expert

VC Nominee

Industrial Representative

Member of Other Department

Student Nominee

Departmental members:

**Recommended Books:**

1. Food and Dairy Microbiology –M.K.Rao, Mangalam Pub.
2. Food Microbiology – M.R. Adams and M.O. Moss, New Age International Pvt. Ltd.
3. Industrial Microbiology – Jr. L.E. Casida New Age Internatinal Pvt. Ltd.
4. Food Microbiology – W. C. Frazier and D.C. Westhoff, Tata McGraw Hill Pub.
5. Industrial Microbiology – Prescott and Dunn, CBS Pub. New Delhi
6. Food biotechnology – V. Mehta, Camus books
7. Basic Food Microbiology - Banwart George J.
8. Food Microbiology: Fundamentals and Frontiers -Dolle
9. Biotechnology: Food Fermentation Microbiology, Biochemistry and Technology. Volume 2 - Joshi.
10. Fundamentals of Dairy Microbiology - Prajapati.
11. Essentials of Food Microbiology. Edited by John Garbult. Arnold International Students Edition.
12. Microbiology of Fermented Foods. Volume II and I. By Brian J. Wood.Elsiever Applied Science Publication.
13. Microbiology of Foods - John C. Ayres. J. OrwinMundt. William E. Sandinee. W. H. Freeman and Co.
14. Dairy Microbiology - Robinson. Volume II and I.



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M.Sc. – MICROBIOLOGY

SEMESTER III

PAPER – IIIB (Elective)

MMB 303 B AGRICULTURE MICROBIOLOGY

Max. M. – 80; Min. M. – 16

Upon successful completion of the course students will be able –

- ❖ To understand the habitat of microorganisms with reference to Agriculture
- ❖ To be familiar with the plant pathogenic characters of microorganisms
- ❖ To know the degradation and toxic effects of microorganisms for plants
- ❖ To study positive effects of microorganisms in terms of Agriculture

**Unit - I**

- Microorganisms of soil, rhizosphere and phyllosphere microflora, Brief account of Microbial interactions: antagonism, symbiosis, mutualism, commensalisms, synergism and parasitism
- Biogeochemical cycles: Nutrient cycle, Carbon cycle, Nitrogen cycle, Phosphorous cycle and Sulphur cycle

**Unit- II**

- Role of enzymes and toxins in plant pathogenesis
- Fungal diseases of plants: Rusts of wheat, linseeds; late blight of potato; red rot of sugarcane
- Bacterial diseases of plants : Citrus canker, blight of rice
- Viral diseases of plants: Leaf curl of Papaya, vein clearing of lady's finger
- Physical, chemical and Biological control of plant diseases (Bacterial control of insect pests: Bacillus thuringiensis as bacterial insecticide, Viral control of insect pests: Nuclear polyhedrosis viruses (NPV) and cytoplasmic polyhedrosis viruses (CPV), Fungal control of insect pests: Entomopathogenic fungi : Metarhiziumanisopliae, Beauveria bassiana, Verticillium lecani, Hirsutellathompsoni

**Unit- III**

- Storage fungi: Categories of storage fungi, conditions during storage in relation to damage of seeds, harmful effects
- Mycotoxins and their effect on human being.
- General idea about quarantine.
- Production of biogas and alcohol from agricultural wastes.

**Unit- IV**

- Biofertilizers : Types, production and application.
- Mycorrhizae : Types and their application in agriculture and forestry.
- Vermicomposting.
- Reclamation of waste agricultural land by microorganisms.

**Name and Signatures:**

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Subject Expert

Subject Expert

VC Nominee

Industrial Representative

Member of Other Department

Student Nominee

Departmental members:

**Recommended Books:**

1. Soil Microbiology by Prof. N.S. Subba Rao, Fourth edition, Oxford and IBH Publishing CO. PVT., LTD., New Delhi
2. Introduction to soil microbiology. Alexander M. (1977) John Wiley & Sons, Inc., New York.
3. Modern Soil Microbiology, Dirk J, Elias V, Trevors JT, Wellington, EMH (1997) Marcel Dekker INC, New York.

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M.Sc. MICROBIOLOGY

SEMESTER -III

**MMBL 05 LAB COURSE I: BIOPHYSICAL TECHNIQUE, INSTRUMENTATION AND  
BIOINFORMATICS**

**List of Practical Exercises**

M.M. - 100

**I Biophysical Technique, Instrumentation and Bioinformatics**

1. Separation of Carbohydrates by Paper Chromatography
2. Separation of Amino acids by Paper Chromatography
3. Separation of Lipids by Thin Layer Chromatography
4. Demonstration Column Chromatography
5. Demonstration HPLC and GC
6. Determination of  $\lambda$  max for different coloured solution
7. Verification of Lambert-Beers Law by UV-VIS Spectrophotometer
8. Separation of Proteins by Electrophoresis
9. Determination of molecular size of DNA by Agarose gel Electrophoresis
10. Confirmation of immune response by Immunoelectrophoresis
11. Demonstration of Differential, rate zonal and equilibrium density gradient centrifugation
12. Assessment of scientific data from Literature data bases (PUBMED, LITDB, Medline)
13. Assessment of nucleic acid databases for retrieval of gene sequence
14. Protein databases for retrieval of amino acid sequence of target protein
15. Pair wise sequence alignment using Dot matrix
16. Demonstration of multiple sequence alignment using BLAST

**Name and Signatures:**

  
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Subject Expert

  
Subject Expert

VC Nominee

Industrial Representative

  
Member of Other Department

  
Student Nominee

Departmental members:











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M.Sc. MICROBIOLOGY

SEMESTER -III

MMBL 06 LAB COURSE II: MEDICAL, FOOD AND DAIRY MICROBIOLOGY/ AGRICULTURE

MICROBIOLOGY

List of Practical Exercises

M.M. - 100

**I – Medical Microbiology**

1. Isolation and preliminary identification of Normal microbial flora of the skin.
2. Effect of detergents and soaps on the Normal flora of skin.
3. Isolation and preliminary identification of microbial flora of teeth crevices.
4. Isolation and preliminary identification of microbial flora from saliva.
5. Urine culture and its microbiological analysis.
6. Isolation and preliminary identification of enteric pathogens using TSIA medium.

**II – Food and Dairy Microbiology**

1. Isolation and preliminary identification of microorganisms from different food (Cereals, sugar products, meat and meat products, milk and milk products, fermented food)
2. Isolation and preliminary identification of microorganisms from different spoiled fruit and vegetables.
3. Study of different chemical preservatives and additives used for preservation of food.
4. Determination of quality of milk samples by Methylene Blue Reductase test.
5. Detection of number of bacteria in milk by SPC method
6. Microbiological examination of fresh and canned foods
7. Detection of Mycotoxins/ Aflatoxin from contaminated grains

**III – Agriculture Microbiology**

1. Study the bacterial, fungal and viral diseases in plants.
2. Isolation of rhizobia from root nodules of leguminous plants.
3. Inoculation of seeds with rhizobia.
4. Study of pesticidal activity of Bacillus thuringiensis.
5. Isolation of VAM spores from soil.
6. Isolation of Azotobacter species from soil.
7. Isolation of microorganisms from rhizosphere.

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