



# **UNIVERSITY OF MYSORE, MYSURU**

**CHOICE BASED CREDIT SYSTEM (CBCS)**

**&**

**CONTINUOUS ASSESSMENT AND GRADING PATTERN (CAGP)**

**Based**

## **B. Sc. MICROBIOLOGY SYLLABUS**

**Under**

**MODIFIED NEP SCHEME: 2024-25**

Board of Studies in Microbiology  
Department of Studies in Microbiology  
University of Mysore  
Manasagangotri, Mysuru 570 006  
Karnataka, India

**CBCS based Undergraduate Microbiology Syllabus for Modified NEP scheme**

**Proposed Semester-wise distribution of the course structure**

<b>Paper code</b>	<b>Paper type</b>	<b>Title of the paper</b>	<b>Credits Assigned</b>	<b>Instructional hours per week</b>
<b>SEMESTER – I</b>				
Major	DSC-1: Theory-I	Introduction to Microbiology and Microbial Diversity	<b>3</b>	<b>3</b>
	DSC-1: Practical-I	Introduction to Microbiology and Microbial Diversity	<b>2</b>	<b>4</b>
<b>SEMESTER – II</b>				
Major	DSC-2: Theory-II	Microbial Physiology and Genetics	<b>3</b>	<b>3</b>
	DSC-2:Practical-II	Microbial Physiology and Genetics	<b>2</b>	<b>4</b>
<b>SEMESTER – III</b>				
Major	DSC-3: Theory-III	Molecular Biology and Environmental Microbiology	<b>3</b>	<b>3</b>
	DSC-3:Practical-III	Molecular Biology and Environmental Microbiology	<b>2</b>	<b>4</b>
Elective	ELE-1: Theory	Microbial Quality Control in Industries	<b>3</b>	<b>3</b>
<b>SEMESTER – IV</b>				
Major	DSC-4: Theory-IV	Genetic Engineering and Agricultural Microbiology	<b>3</b>	<b>3</b>
	DSC-4:Practical-IV	Genetic Engineering and Agricultural Microbiology	<b>2</b>	<b>4</b>
Elective	ELE-2: Theory	Plant and Animal Microbiome	<b>3</b>	<b>3</b>
Skill	SEC-1: Theory	Microbial and Molecular Techniques	<b>2</b>	<b>2</b>
<b>SEMESTER – V</b>				
Major-	DSE: Theory-V	Food and Industrial Microbiology	<b>3</b>	<b>3</b>
	DSE: Practical-V	Food and Industrial Microbiology	<b>2</b>	<b>4</b>
	SEC- Theory-	-		
<b>SEMESTER – VI</b>				
Major-	DSE: Theory-VI	Immunology and Medical Microbiology	<b>3</b>	<b>3</b>
	DSE: Practical-VI	Immunology and Medical Microbiology	<b>2</b>	<b>4</b>
	SEC- Theory-	-		

**DSC - Discipline Specific Course, DSE- Discipline Specific Elective,  
SEC- Skill Enhancement Course**

## SCHEME OF VALUATION

### MAXIMUM MARKS

COURSE TYPE	C1		C2		C3		TOTAL
	THEORY	LAB	THEORY	LAB	THEORY	LAB	
DSC	10	5	10	5	80	40	150
DSE	10	5	10	5	80	40	150
ELE	10		10		80		100
SEC	5	-	5	-	40		50

**NOTE;**

1. FOR DSC AND DSE, C1 AND C2 WILL BE CONDUCTED FOR 20 MARKS (THEORY) WITH 1 HOUR DURATION, 10 MARKS (LAB) WITH CONTINUOUS ASSESMENT THROUGH RECORD VALUATION AND MARKS REDUCED TO ASSIGNED MARKS. THE SCHEME OF EVALUATION IS SAME FOR ELECTIVE PAPER WITHOUT PRACTICAL.
2. C3 WILL BE CONDUCTED FOR 80 MARKS (THEORY) WITH 3 HOUR DURATION, 40 MARKS (LAB) WITH 3 HOUR DURATION.
3. IN CASE OF SEC, C1 AND C2 WILL BE CONDUCTED FOR 10 MARKS WITH 30 MINUTES DURATION AND REDUCE TO ASSIGNED MARKS. C3 WILL BE CONDUCTED FOR 40 MARKS.

### III SEMESTER

#### DSC-3: MOLECULAR BIOLOGY AND ENVIRONMENTAL MICROBIOLOGY

##### PAPER-III

48 (3hrs./week)

##### Unit I: Genetic material and Transcription

12 hrs.

**Genetic material:** Chemical basis of heredity, Rosalind Franklin experiment. Chargaff's rules. Watson and Crick model of DNA, DNA types. RNA-types, structure and importance. Minor RNAs- RNAi, siRNA, snRNA, miRNA and shRNA.

**DNA replication:** Definition and modes. Meselson-Stahl experiment. Enzymes and proteins involved in DNA replication. General mechanism of semi-conservative replication.  $\Theta$  (theta) and rolling circle mode of replication. **Transcription:** Transcription unit- concept of gen, promoter concept, Bacterial RNA polymerase, stages of transcription.

##### Unit II: Translation and regulation of gene expression

12 hrs.

**Translation:** Genetic code- features, Wobble hypothesis. Translation- steps in polypeptides synthesis in prokaryotes. Post-translational modifications of proteins- protein folding and targeting. Protein maturation and secretion- protein splicing and molecular chaperones. Comparative account of prokaryotic and eukaryotic translation.

**Gene regulation:** Operon concept, inducible and repressible operon. *lac* operon- structure, negative and positive control, catabolite repression. *trp* operon- structure, regulation by repression and attenuation.

##### Unit III: Microbiology of Air and Soil

12 hrs.

**Aeromicrobiology:** Scope of aerobiology. Airomicroflora of indoor and outdoor environments. Techniques to trap air-borne microorganisms: Passive (gravity slide, Petri plate exposure ) and active spore traps (Andersen sampler, Rotorod sampler, Vertical cylinder and Hirst spore trap).

**Microbiology of Soil:** Soil types and soil profile. Microbial flora of soil. Role of microbes in soil processes: biodegradation of pectin, cellulose and lignin. Rhizosphere microorganisms: rhizosphere, rhizoplane and PGPR. Interaction among microorganisms. Plant microbe interaction- mycorrhizae and their types. Role of earthworm gut microflora in vermicomposting.

##### Unit IV: Microbiology of water and wastewater

12 hrs.

**Aquatic Microbiology:** Water as a microbial habitat. Microorganisms of freshwater, marine water and brackish water. Waterborne pathogens- types and source. Waterborne diseases- Cholera, Amoebic dysentery and Hepatitis. Microbiological analysis of water: SPC, MPN, IMViC reactions, membrane filter technique. Water purification in municipal water supply.

**Sewage Microbiology:** Sources of wastewater. Physical, chemical and microbiological characteristics of wastewater. BOD and COD. Wastewater treatment: septic tank, municipal wastewater treatment- primary, secondary and tertiary. Composting.

### III SEMESTER

#### MOLECULAR BIOLOGY AND ENVIRONMENTAL MICROBIOLOGY

##### PRACTICAL-3

(4hrs/week)

1. Micropipeting: Moving very small volumes accurately.
2. Preparation of phosphate and citrate buffer.
3. Extraction of DNA by spooling method.
4. Isolation of genomic DNA from bacteria by heat lysis method.
5. Estimation of DNA by Diphenylamine method.
6. Determination of purity of DNA.
7. Isolation of airborne microorganisms (bacteria and fungi) by petriplate exposure method.
8. Trapping of microorganisms from air by gravity slide technique
9. Isolation and enumeration of bacteria and fungi from soil by serial dilution method.
10. Standard analysis of water and Determination of MPN
11. Biochemical differentiation of Enterobacteriaceae isolates by IMViC reactions.
12. Determination of bacteriological quality of water by H<sub>2</sub>S paper strip test.
13. Estimation of total solids of sewage and Determination of BOD of sewage.
14. Study of Watson and Crick model of DNA, tRNA, semi-conservative replication of DNA, transcription, translation, *lac* operon, air samplers, flocculator, clarifier, sand filter, chlorinometer, septic tank, trickling filter, oxidation pond and anaerobic digester through micrographs/schematic representations.
15. Visit to water treatment plant/sewage treatment plant/Virtual demonstration of water and waste water treatment/Submission of air borne fungi or bacterial culture

## **Text Books / References**

1. Alberts Bruce, Johnson, A., Lewis, J., Raff, M., Roberts, K., Walter, P. (2014). Molecular Biology of the Cell. 5th Edition, Taylor and Francis. New York, USA.
2. Alexander, A. M. 1987. Introduction to soil Microbiology, 5th ed., John Wiley and sons.
3. Allison A. Elizabeth (2012). Fundamental Molecular Biology, 2nd Edition. J Willey and Sons, Hoboken, New Jersey
4. Atlas, R. M. and Bartha, R. (1993). Microbial Ecology: Fundamentals and applications, 3rd ed., Benjamin and Cummings Pub.Co. New York.
5. Daniel Environmental Microbiology.
6. De Robertis, E. D. P. and De Robertis, E. M. F. (2006) Cell and Molecular Biology, 8th edition. Lippincott Williams and Wilkins, Philadelphia.
7. Frederick, M., Ausubel, Roger Brent, Robert, E., Kingston, David, D., Moore, J. G. Seidman, John A. Smith, Kevin Struhl (2003). Current Protocols in Molecular Biology. John Wiley & Sons, New York, United States.
8. Freifelder's Essentials of Molecular Biology. George M Malacinski, 4<sup>th</sup> ed. 2015
9. Grant, W. D. and P. E, Long: 1981 Environmental Microbiology, Thomson Litho Ltd.
10. James, D. Watson, Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine, Richard Losick. Molecular Biology of the Gene, 7th edition. 2017
11. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley & Sons. Inc.
12. Krebs, J., Goldstein, E. and Kilpatrick, S. (2013). Lewin's Essential Genes, 3rd Ed., Jones and Bartlett Learning.
13. Michael, J. Pelczar, Jr. E. C. S. Chan, Moel: Microbiology, Mc Graw Hill Book Company, New York).
14. Mitchell, R. (1992), Introduction to Environmental Microbiology, Prentice Hall Inc, Englewood Cliffs.
15. Powar and Dagainwala (1996). General Microbiology, Vol 1. Himalaya Publishing House, Bombay.
16. Powar and Dagainwala (1996). General Microbiology, Vol 2. Himalaya Publishing House, Bombay.
17. Rao, M. N. and Datta, A. K. (1987). Waste Water Treatment. Oxford and I.B.H.
18. Rheinhermer, G. (1986). Aquatic Microbiology John Wiley and sons, New York.
19. Watson, J. D., Baker, T. A., Bell, S. P. et al., (2008) Molecular Biology of the Gene, 6th Ed., Benjamin Cummings.

### III SEMESTER

#### ELE-1: MICROBIAL QUALITY CONTROL IN INDUSTRIES

##### ELECTIVE-1

48 (3hrs./week)

##### Unit I Biohazards and Biosafety

12 hrs.

Biohazards- definition, sources, types, risk group. Risk assessment of biohazardous agents. Good laboratory practices and Good microbiological practices. Biosafety cabinets: working of biosafety cabinets, using protective clothing. Biosafety levels- procedures and practices, safety equipment and laboratory facilities for BSL1, BSL-2, BSL-3 and BSL4. Discarding biohazardous waste- Methodology of disinfection, autoclaving and incineration.

##### Unit II Microbiological quality analysis of Air

12 hrs.

**Microflora of Air:** Bioaerosols. Airborne microorganisms (bacteria, viruses, fungi) and their impact on human health and environment. Significance air microflora in food and pharma industries and operation theatres. Aeroallergens.

**Collection of air sample and analysis:** Bioaerosol sampling, air samplers and methods of analysis. Identification characteristics of bioaerosols. Bioaerosols inactivation mechanisms- UV light, desiccation, incineration.

##### Unit III Microbiological quality analysis of Food and Water

12 hrs.

**Pathogenic Microorganisms of Importance in Food & Water:** SOP for water and food sampling. Culture media to detect specific microorganisms- XLD agar, Salmonella Shigella agar, Manitol salt agar, EMB agar, McConkey agar and Sabouraud agar.

**Methods of analysis for foods and water:** Aerobic Plate Count (APC), Most Probable Numbers (MPN), Direct Microscopic Counts (DMC). Immunological and molecular methods of detection of microbial contaminants in food and water.

##### Unit IV Food safety and standards

12 hrs.

Introduction to food safety. Role of microbiologist in food industries. Food Safety and Standards Act, 2006- scope, salient features and general principles. Food Safety Management Systems: GMP and GHP. HACCP- principles, flow diagrams, applications. FSSAI- structure, statutory power, initiatives, functions, landmark cases and challenges. FDA and BIS. BIS standards for common foods and drinking water.

## **Text Books / References**

1. Atlas, R. M. and Bartha, R. (2000). Microbial Ecology: Fundamentals & Applications. 4th edition. Benjamin/Cummings Science Publishing, USA.
2. Baird, R. M., Hodges, N. A. and Denyer, S. P. (2005) Handbook of Microbiological Quality control in Pharmaceutical and Medical Devices, Taylor and Francis Inc.
3. da Silva, N., Taniwaki, M. H., Junqueira, V. C., Silveira, N., Nascimento, M. S. and Gomes, R. A. R. (2012) Microbiological Examination Methods of Food and WaterA Laboratory Manual, CRC Press.
4. Food Safety and Standards Authority of India (FSSAI) Food Safety and Standards Authority of India, Government of India. Retrieved 2 April 2012.
5. Garg, N., Garg, K. L. and Mukerji, K. G. (2010) Laboratory Manual of Food Microbiology I K International Publishing House Pvt. Ltd.
6. Harrigan, W. F. (1998) Laboratory Methods in Food Microbiology, 3rd ed. Academic Press.
7. Hurst, C. J, Crawford, R. L., Garland, J. L. and Lipson, D. A. (2007) Manual of Environmental Microbiology, 3rd edition, ASM press.
8. Jay, J. M., Loessner, M. J., Golden, D. A. (2005) Modern Food Microbiology, 7th edition. Springer.
9. Maier, R. M., Pepper, I. L. and Gerba, C. P. (2009). Environmental Microbiology. 2nd edition, Academic Press.



## IV SEMESTER

### DSC-4: GENETIC ENGINEERING AND AGRICULTURAL MICROBIOLOGY

#### PAPER-IV

48 (3hrs./week)

##### Unit I: Introduction to Genetic Engineering

12 hrs.

**Molecular tools in gene cloning:** Milestones in genetic engineering. Steps involved in gene cloning. Cloning tools: restriction enzymes- nomenclature, types, mode of action and applications. DNA modifying enzymes and their applications: DNA polymerases, methylases, terminal deoxynucleotidyl transferase, kinases and phosphatases and DNA ligases.

**Cloning Vectors:** Definition and Properties. Plasmid vectors: pBR322 and pUC18. Bacteriophage lambda and M13 vectors. Cosmids, BACs, YACs. Expression vectors: Baculovirus vectors, mammalian SV40 vectors. Cloning host- *Escherichia coli*

##### Unit II: Methods in molecular cloning

12 hrs.

**Gene screening:** Isolation of DNA. Separation of DNA by agarose gel electrophoresis. DNA transfer methods. Blotting techniques, DNA Hybridisation methods-Colony and Plaque hybridization. Sanger's method of DNA sequencing and Next Generation sequencing. PCR- types and applications.

**Applications of Recombinant DNA Technology:** Genomic and cDNA libraries: construction and uses. Products of recombinant DNA technology: recombinant insulin, hGH, recombinant vaccines and Bt Cotton. Gene therapy and RFLP, DNA finger printing

##### Unit III: Microbes in sustainable agriculture

12 hrs.

**Biofertilization:** Biofertilizers-definition, types-Nitrogen fixing and Phosphate solubilizing. Mass production, mode of application, advantages and limitations of bacterial inoculants (*Rhizobium*, *Azotobacter*, *Azospirillum*) and cyanobacterial inoculants. Role of *Frankia* and VAM in soil fertility.

**Biological control:** Biopesticides: definition. Mode of action, factors influencing, target pests, advantages and limitations of bacterial, viral and fungal pesticides-. Microbial herbicides. Secondary agriculture biotechnology- silage, biomanure and biofuels.

##### Unit IV: Plant pathology

12 hrs.

**Introduction to plant pathology:** Historical perspectives. Classification and spread of plant diseases. Virulence factors of pathogens in disease development. Defense mechanisms in plants- structural and biochemical. Horizontal and vertical resistance.

**Plant diseases:** Study of symptoms, etiology, epidemiology and management of diseases caused by fungi (tikka disease of Groundnut, blast disease of Paddy, powdery mildew of Mulberry), bacteria (citrus canker, angular leaf spot of Cotton, Sandalwood spike), viruses (bunchy top of Banana, Papaya ring spot) and viroid (Potato spindle tuber disease). Post harvest pathology.

## SEMESTER-IV

### GENETIC ENGINEERING AND AGRICULTURAL MICROBIOLOGY

#### PRACTICAL-IV

(4hrs/week)

1. Visualization of DNA by agarose gel electrophoresis.
2. Isolation of plasmid DNA
3. Preparation of master and replica plate.
4. Designing of primers for DNA amplification.
5. Demonstration of amplification of DNA by PCR.
6. Interpretation of sequencing gel electropherogram.
7. Demonstration of blue-white screening of recombinants.
8. Study of antagonism between microorganisms.
9. Seed health testing by standard blotter method.
10. Isolation and characterization of *Rhizobium* from root nodules
11. Study of *Anabaena* from *Azolla*
12. Study of VAM, biofertilizers and biopesticides.
13. Gram staining of citrus canker specimen
14. Mounting of fungal disease specimens- powdery mildew of Mulberry and tikka disease of Groundnut.
15. Study of pBR322, agarose gel electrophoresis, Microinjection, Southern blotting, PCR, colony hybridization products of recombinant DNA technology and plant diseases through micrographs/schematic representations.

## **Text Books / References**

1. Brown, T. A. (2010). Gene Cloning and DNA Analysis. 6th edition. Blackwell Publishing, Oxford, U. K.
2. Clark, D. P. and Pazdernik, N. J. (2009). Biotechnology: Applying the Genetic Revolution. Elsevier Academic Press, USA.
3. Gardner, E. J., Simmons, M. J. and Snustad, D. P. (2008). Principles of Genetics. 8th Ed. Wiley-India.
4. Krebs, J., Goldstein, E. and Kilpatrick, S. (2013). Lewin's Essential Genes, 3rd Ed., Jones and Bartlett Learning.
5. Mehrotra, R. S., Plant Pathology, Tata Mc Graw Hill Publications Limited, New Delhi.
6. Michael, J. Pelczar, Jr.E. C. S. Chan, Moel: Microbiology, Mc Graw Hill Book Company, New york).
7. Powar and Dagainwala (1996). General Microbiology, Vol 1. Himalaya Publishing House, Bombay.
8. Powar and Dagainwala (1996). General Microbiology, Vol 2. Himalaya Publishing House, Bombay.
9. Primrose, S. B. and Twyman, R. M. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.
10. Primrose, S. B. and Twyman, R. M. (2008). Genomics: Applications in human biology. Blackwell Publishing, Oxford, U.K.
11. Rangaswamy, G. and Bagyaraj, D. J. (2001), Agricultural Microbiology, 2nd ed. Prentice hall of India pvt.ltd., New Delhi.
12. Sambrook, J. and Russell, D. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press.
13. Subba Rao, N. S. (2002) Soil Microorganisms and Plant Growth 4th ed., Oxford and IBH Pub.Co.Pvt.ltd., New Delhi.
14. Subha Rao, N. S., 1988. Biofertilizers in Agricultural 2nd ed.Oxford and IBH Pub.Co., New Delhi.
15. Wiley, J. M., Sherwood, L. M. and Woolverton, C. J. (2008). Prescott, Harley and Klein's Microbiology. McGraw Hill Higher Education.

## **IV SEMESTER**

### **ELE-2: PLANT AND ANIMAL MICROBIOME**

#### **ELECTIVE-2**

**48 (3hrs./week)**

#### **Unit I: Introduction to Microbiome**

**12 hrs.**

Microbiome- Definition and scope. Microbiome in early life. Host-associated microbiomes. Anatomical locations of microbiome in animals and plants. Culturing organisms of interest from the microbiome: bacterial, archaeal, fungal, viral and yeast. Extracting whole genomes from the microbiome to study microbial diversity. Symbiosis host-bacteria. Normal human microbiota and their role in health. Microbiome other than digestive system.

#### **Unit II: Plant Microbiome**

**12 hrs.**

Basics of plant microbiome. Dynamic relationships between plant and microorganisms. Plant microbiome and plant health. Use of plant microbiome interaction for nutrients uptake, nitrogen fixation, pollutants cleaning and soils/plants health improvement. Microorganisms for carbon sequestration. Plant microbiome in practice. Current techniques related to plant microbiome research. Future research about plant microbiome.

#### **Unit III: Animal Microbiome**

**12 hrs.**

Diversity of microbiome across different animal species, ecological niches and developmental stages. Gut microbiome of livestock, skin microbiome of reptiles, microbiome of earthworm and microbiome of honeybees. Rumen microbiome- Diversity and factor influencing the rumen microbiota. Establishment of rumen microbiota at birth. Fermentation in rumen. Rumen microbiome and methanogenesis. Molecular techniques and ‘omic’ approaches to understand rumen microbial function.

#### **Unit IV: Human Microbiome**

**12 hrs.**

Introduction to the human microbiome. The holobiont theory of evolution. Pre and post-natal microbiome. The gut microbiome. Dysbiosis and the gut microbiome. Antibiotics and the human microbiome. Diet and the human microbiome. Behavior and the microbiome (the gut brain axis). Probiotics, prebiotics synbiotics and the human microbiome. Drug metabolism by the microbiome. Human Microbiome Project. Fecal microbiota transplantation.

## **Text Books / References**

1. Angela E Douglas, (2018). Fundamentals of Microbiome Science: How Microbes Shape Animal Biology. Princeton University Press. 248pp.
2. Cieslak, A., M. Szumacher-Strabel, A. Stochmal & W. Oleszek. 2013. Plant components with specific activities against rumen methanogens. – *Animal*, 7(s2): 253-265.
3. Edward Ishiguro, Natasha Haskey and Kristina Campbell, (2018). Gut Microbiota. 1st edition. 2008pp.
4. Emeran Mayer, (2018). The Mind-Gut Connection: How the Hidden Conversation within our bodies impacts our mood, our choices, and our overall Health. Harper Wave, 336pp.
5. Giulia Enders and Jill Enders, (2018). Gut: The Inside Story of Our Body's Most Underrated Organ (Revised Edition). Greystone Books, 304pp.
6. Hart, K. J., D. R. Yañez-Ruiz, S. M. Duval, N. R. McEwan & C. J. Newbold. 2008. Plant extracts to manipulate the rumen. – *Animal Feed Science and Technology*, 147(1-3): 8-35
7. Hungate, R. E. 1966. The rumen and its microbes. – Academic Press, New York, USA, 533 pp
8. Natalia V Beloborodova, (2021). Human Microbiome. IntechOpen, 166pp. Gregory, P. H. (1961). The Microbiology of the atmosphere. Interscience Publishers, New York.
9. Tille, P. (2013) Bailey's and Scott's Diagnostic Microbiology, 13th edition, Mosby.

## IV SEMESTER

### SEC-1: MICROBIAL AND MOLECULAR TECHNIQUES

**SKILL PAPER-1**

**32 (2hrs./week)**

#### Unit I: **Microbial Techniques**

**16 hrs.**

**Methods and practices of cleaning and management of lab:** Learning and Practice of Integrated clean-in-place (CIP) and sterilize-in-place (SIP) as per industry standards. SOP for various equipment in the QC Lab. Sterility check, Bio-burden and Logbook maintenance.

**Handling and calibration of lab equipment-** weighing balance, micropipette, centrifuge, pH meter, water bath and colony counter. Preparation of normality, molarity and buffer solutions.

**Types of culture media and maintenance of culture:** Preparation of various culture media. Cultivation of bacteria, fungi, actinomycetes and algae. Isolation and preservation of pure culture. Morphological and biochemical characterization of bacteria.

#### Unit II: **Molecular Techniques**

**16 hrs.**

**Centrifugation and Chromatography:** Principles of centrifugation and ultracentrifugation techniques and its applications. Partition, adsorption, ion exchange, exclusion and affinity chromatography- principle and applications.

**Spectrophotometry and Electrophoresis:** UV and visible spectrophotometric techniques- principle and application. Electrophoretic technique: agarose and polyacrylamide gel electrophoresis- components, working principle and applications.

**Radiobiology:** Radioactivity, radioisotopes. Radioisotope dilution technique. Radioisotope technique: Autoradiography-.working principle and uses. Radiation safety and protection.

## **Text Books / References**

1. Aurora Blair. Laboratory Techniques & Experiments in Biology. Intelliz Press
2. Beckner, W. M., Kleinsmith, L. J. and Hardin, J. (2000). The world of cell. IV edition Benjamin/Cummings
3. Black J. G. (2002). Microbiology- Principles and Explorations. JohnWiley & SonsInc. NewYork,
4. Cambridge University Press.
5. Colin A. Ramsden (2014). "Analytical Molecular Biology". Oxford University Press.
6. Cowan and Steel's Manual for the Identification of Medical Bacteria. G. I. Barrow (Editor), R. K. A. Feltham (Editor) 3rd Edition. 2004
7. John M. Walker and Ralph Rapley (2014). "Molecular Biomethods Handbook". HumanaPress.
8. Maheswari, D. K. (2010). Practical Microbiology. S Chand publications
9. Michael Lufaso (2016). "Laboratory Skills for Science and Medicine: An Introduction". CRCPress.
10. Murphy, D. B. (2001). Fundamental of Light Microscopy &Electron Imaging.1st Edition. Wiley-Liss.
11. Murphy, D. B. (2001). Fundamental of Light Microscopy &Electron Imaging.1st Edition. Wiley-Liss.
12. Plummer, D. T. (1987). An Introduction to Practical Biochemistry. McGraw Hill Publication
13. Pranav Kumar (2016). Fundamentals and Techniques of Biophysics and Molecular Biology
14. Prescott, M. J., Harley, J. P. and Klein, D. A. (2002). Microbiology. 5th Edition WCB Mc GrawHill, New York,
15. Wilson and Walker (2000). Principles and Techniques in Practical Biochemistry. 5th Edition

## **SCHEME OF PRACTICAL EXAMINATION**

### **III SEMESTER**

#### **PRACTICAL-III: MOLECULAR BIOLOGY AND ENVIRONMENTAL MICROBIOLOGY**

**Duration: 3 hours**

**Max. Marks: 40**

**I. Demonstrate or perform the experiment A giving principle and procedure. Record the result. 12 Marks**

(Extraction of DNA by spooling method / Isolation of DNA by heat lysis method / Estimation of DNA by Diphenylamine method / Determination of purity of DNA)

(Demonstration- 5 Marks, Principle and Procedure- 5 Marks and Result- 2 Marks)

**II. Perform or demonstrate the experiment B giving principle and procedure. Record the result. 12 Marks**

(Petriplate exposure method, Isolation and enumeration of microorganisms from soil / Determination of MPN / Determination of BOD of sewage / Estimation of total solids of sewage)

(Demonstration- 5 Marks, Principle and Procedure- 5 Marks and Result- 2 Marks)

**III. Conduct or identify the test C. Record and interpret the result. 05 Marks**

(Presumptive test / Confirmed test / Indole production test / MR test / VP test / Citrate utilization test / H<sub>2</sub>S strip test)

(Conduct / Identification- 2 Marks, Result- 1 Mark, Interpretation- 1 Mark)

**IV. Write critical notes on D, E and F. 3x2=06 Marks**

(Micropipette, Watson and Crick model of DNA, tRNA, semi-conservative replication of DNA, transcription, translation, *lac* operon, Air samplers, flocculator, clarifier, sand filter, chlorinometer, septic tank, trickling filter, oxidation pond, anaerobic digester)

(Identification- 1 Mark and Critical comment- 1 mark)

**V. Viva-voce**

**05 Marks**



## **SCHEME OF PRACTICAL EXAMINATION**

### **IV SEMESTER**

#### **PRACTICAL-IV:GENETIC ENGINEERING AND AGRICULTURAL MICROBIOLOGY**

**Duration: 3 hours**

**Max. Marks: 40**

- I. Demonstrate or perform the experiment A giving principle and procedure. Record the result. 12 Marks**

(Visualization of DNA by agarose gel electrophoresis / Preparation of master and replica plate / Blue-white screening of recombinants)

(Demonstration- 5 Marks, Principle and Procedure- 5 Marks and Result- 2 Marks)

- II. Perform or demonstrate the experiment B giving principle and procedure. Record the result. 12 Marks**

(Antagonism between microorganisms / Seed health testing by standard blotter method / Gram staining of citrus canker specimen)

(Demonstration- 5 Marks, Principle and Procedure- 5 Marks and Result- 2 Marks)

- III. Identify the organism in the materials C with labeled diagrams and reasons. 05 Marks**

(*Anabaena* from *Azolla* / Tikka disease of Groundnut / Powdery mildew of mulberry)

(Identification- 1 Mark and Labelled diagram with reasons- 4 Marks)

- IV. Write critical notes on D, E and F. 3x2=06 Marks**

(pBR322, agarose gel electrophoresis, microinjection, PCR, colony hybridization, products of recombinant DNA technology, specimens of plant disease, biofertilizers and biopesticides)

(Identification- 1 Mark and Critical comment- 1 mark)

- V. Viva-voce**

**05 Marks**

**QUESTION PAPER PATTERN OF THEORY EXAMINATION (DSC & ELECTIVE)**

**III and IV SEMESTER B. Sc. MICROBIOLOGY  
(Under SEP Scheme 2024-25)**

**Duration: 3 Hours**

**Max. Marks: 80**

**Instructions:** *Answer all questions.*

*Draw neat labeled diagrams wherever necessary.*

**I. Answer any eight of the following (10 questions to be asked):**

**2×8=16**

2 questions from Unit 1  
3 questions from Unit 2  
2 questions from Unit 3  
3 questions from Unit 4

} Question paper pattern-1

**OR**

3 questions from Unit 1  
2 questions from Unit 2  
3 questions from Unit 3  
2 questions from Unit 3

} Question paper pattern-2

**II. Answer any four of the following (6 questions to be asked):**

**6 ×4=24**

1 question from Unit 1  
2 questions from Unit 2  
1 question from Unit 3  
2 questions from Unit 4

} Question paper pattern-1

**OR**

2 questions from Unit 1  
1 question from Unit 2  
2 questions from Unit 3  
1 question from Unit 4

} Question paper pattern-2

**III. Answer any four of the following (6 questions to be asked):**

**10×4=40**

2 questions from Unit 1  
1 question from Unit 2  
2 questions from Unit 3  
1 question from Unit 4

} Question paper pattern-1

**OR**

1 question from Unit 1  
2 questions from Unit 2  
1 question from Unit 3  
2 questions from Unit 4

} Question paper pattern-2

**Note: Weightage given to each unit is 29±1 Marks**

**QUESTION PAPER PATTERN OF SKILL PAPER EXAMINATION**

**IV SEMESTER B. Sc. MICROBIOLOGY  
(Under SEP Scheme 2024-25)**

**Duration: 2 Hours**

**Max. Marks: 40**

**Instructions:** *Answer all questions.*

*Draw neat labeled diagrams wherever necessary*

**I. Answer any four of the following (6 questions to be asked):**

**2×4=08**

3 questions from Unit 1

3 questions from Unit 2

**II. Answer any three of the following (4 questions to be asked):**

**4×3=12**

2 questions from Unit 1

2 questions from Unit 2

**III. Answer the following (2 questions to be asked with internal choice):**

**10×2=20**

2 questions from Unit 1

2 questions from Unit 2

**Note: Weightage given to each unit is 34 Marks**

*[Handwritten signatures and dates]*  
17/5/25  
P.K. Mahalingam  
Shubhaya D. Suresh 17/5/2025  
17/5/25  
17/5/25  
17/5/25

*[Handwritten signature]*  
**CHAIRMAN  
BOARD OF STUDIES  
MICROBIOLOGY (PG)  
UNIVERSITY OF MYSORE**





# UNIVERSITY OF MYSORE

(Re-accredited by NAAC with 'A' Grade)

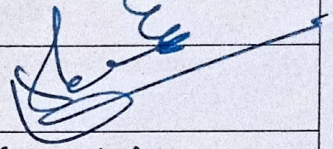
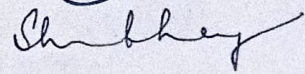
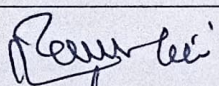
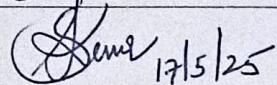
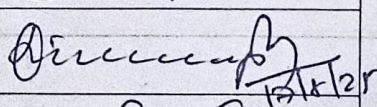
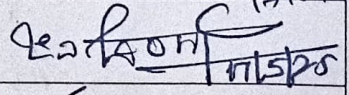
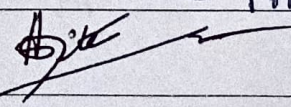
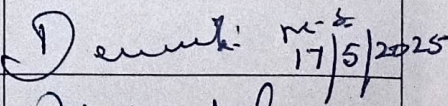
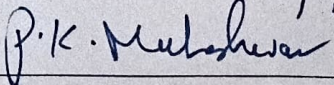
(NIRF-2023: Ranked 44 in University Category & 71 in Overall Category)

## DEPARTMENT OF STUDIES IN MICROBIOLOGY

### Proceedings of the BOS Meeting of Microbiology (CB)

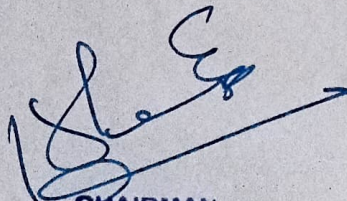
As per the direction of the Registrar, University of Mysore, Mysuru, Board of Studies Meeting of Microbiology (CB) of University of Mysore was conducted on 17/05/2025 at Department of studies in Microbiology, Manasagangotri, University of Mysore, Mysuru. The information about the discussion carried out in the meeting is enclosed with this letter.

#### Members Present:

Sl. No	Name of the BoS Member	Designation	Signature
1.	Prof. M.Y. Sreenivasa	BoS Chairman	
2.	Prof. Shubha Gopal	Member	
3.	Prof. K. Ramachandra Kini	Member	
4.	Prof. V. Shyam Kumar	Member	
5.	Prof. Virupakshaiah, D B M	Member	
6.	Dr. G.S. Siddegowda	Member	
7.	Dr. H S. Jayanth	Member	
8.	Dr. N.S. Devaki	Member	
9.	Dr. P.K. Maheshwar	Special Invitee	

#### Members Absent:

1. Prof. Srinivas C
2. Dr. N. Anuroopa

  
**CHAIRMAN**  
**BOARD OF STUDIES**  
**MICROBIOLOGY (PG)**  
**UNIVERSITY OF MYSORE**



**Details of the Discussion & Decisions Taken at BoS Meeting of Microbiology (CB)**

1. The Chairman BoS in Microbiology welcomed the BoS members and placed the BoS Meeting Agenda before the members.
2. Discussed and approved the changes in the course of B.Sc., Microbiology III & IV Semester syllabi and Scheme of examination 2025-2026.
3. Minor (Less than 10%) changes made in the M.Sc Microbiology Syllabus.
4. Prepared and approved of Question paper pattern & scheme of Practical Examination or B.Sc., Microbiology III & IV Semester 2025-2026.
5. Prepared and approved the Panel of examiners for UG & PG examinations 2025-2026.
6. Any other Matter: Nil
7. The BoS meeting is concluded with the vote of thanks by the Chairman.

*[Signature]*  
17/5/25

P.K. Maheshwari

Shubhaya

D. S. S. S.  
17/5/2025

*[Signature]*

*[Signature]*  
17/5/25

V. S. S. S.

*[Signature]*  
17/5/25

*[Signature]*  
**CHAIRMAN  
BOARD OF STUDIES  
MICROBIOLOGY (PG)  
UNIVERSITY OF MYSORE**



# ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ

(ನ್ಯಾಕ್ ಸಂಸ್ಥೆಯ ಮರು ಮಾನ್ಯತೆಯಲ್ಲಿ 'ಎ' ಗ್ರೇಡ್ ಪಡೆದಿದೆ)

(ಎನ್‌ಐಆರ್‌ಎಫ್-2024: ವಿಶ್ವವಿದ್ಯಾನಿಲಯ ವರ್ಗದಲ್ಲಿ 54ನೇ ಸ್ಥಾನ ಮತ್ತು ಒಟ್ಟಾರೆ ವರ್ಗದಲ್ಲಿ 86ನೇ ಸ್ಥಾನ)

## ಸೂಕ್ಷ್ಮಜೀವಶಾಸ್ತ್ರ ಅಧ್ಯಯನ ವಿಭಾಗ

ಡಾ. ಎಂ.ವೈ.ಶ್ರೀನಿವಾಸಪಿಹೇಚ್.ಡಿ.,ಪಿಡಿಎಫ್(ಯುಎಸ್ಎ)

ಮಾನಸಗಂಗೋತ್ರಿ

ಪ್ರಾಧ್ಯಾಪಕರು ಮತ್ತು BOS ಅಧ್ಯಕ್ಷರು

ಮೈಸೂರು - 570 006

ನಂ/ಎಂ.ಜಿ.ಎಂ.ಬಿ/87/2025-26

ದಿನಾಂಕ: 17-05-2025

ಗೆ,

ಕುಲಸಚಿವರು (ಪರೀಕ್ಷಾಂಗ)

ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ

ಮೈಸೂರು.

ಮಾನ್ಯರೇ,

ವಿಷಯ: 2025-2026ನೇ ಸಾಲಿನ ಅಧ್ಯಯನ ಮಂಡಳಿಯ ವಾರ್ಷಿಕ ಸಭೆಯ ನಡಾವಳಿಯನ್ನು ಕಳುಹಿಸುತ್ತಿರುವ ಬಗ್ಗೆ.

ಉಲ್ಲೇಖ: ವಿ.ವಿ ಆದೇಶ ಸಂಖ್ಯೆ: ಯು.ಎ 2/379/2013-2014 ದಿನಾಂಕ: 05/05/2025

\* \* \* \* \*

ಮೇಲ್ಕಂಡ ವಿಷಯ ಮತ್ತು ಉಲ್ಲೇಖಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ, ಸೂಕ್ಷ್ಮಜೀವಶಾಸ್ತ್ರ ಅಧ್ಯಯನ ವಿಭಾಗದಲ್ಲಿ 2025-26ನೇ ಸಾಲಿನ ಸ್ನಾತಕ ಮತ್ತು ಸ್ನಾತಕೋತ್ತರ ಅಧ್ಯಯನ ಮಂಡಳಿಯನ್ನು ದಿನಾಂಕ: 17-05-2025 ರಂದು ಪೂರ್ವಾಹ್ನ 10.30ಕ್ಕೆ ವಾರ್ಷಿಕ ಸಭೆಯ ನಡಾವಳಿಯನ್ನು ನಡೆಸಿ, ಈ ಕೆಳಕಂಡ ಪ್ರತಿಗಳನ್ನು ಸಿದ್ಧಪಡಿಸಿ ಮುಂದಿನ ಸೂಕ್ತಕ್ರಮಕ್ಕಾಗಿ ಕಳುಹಿಸಿಕೊಡಲಾಗಿದೆ.

1. B.Sc. III & IV Semester Syllabus.
2. B.Sc. Scheme of examination pattern.
3. PG & UG panel of examiners.

ವಂದನೆಗಳೊಂದಿಗೆ,

ತಮ್ಮ ವಿಶ್ವಾಸಿ

(ಎಂ.ವೈ.ಶ್ರೀನಿವಾಸ)

CHAIRMAN  
BOARD OF STUDIES  
MICROBIOLOGY (PG)  
UNIVERSITY OF MYSORE