

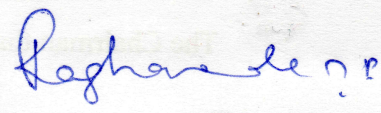
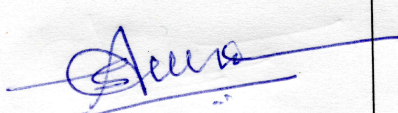
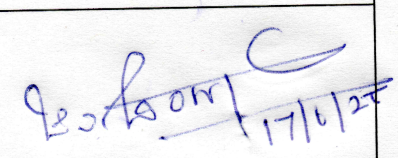
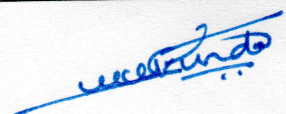
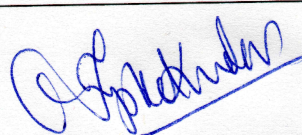
KUVEMPU UNIVERSITY
Dept. of P.G. Studies and Research in Microbiology
Jnana Sahyadri, Shankaraghatta – 577451

Proceedings of Under Graduate Board of Studies in Microbiology held on 17th June 2025,
Department of P.G. Studies & Research in Microbiology, Kuvempu University, Shankaraghatta-
577451 at 11 am.

AGENDA

1. Approval of Panel of Examiners for the B.Sc., Examination related work of B.Sc., Microbiology for the Academic Year 2025-26.
2. Ratification of SEP-Curriculum structure for undergraduate programme for 2024-25 onwards, implemented by Govt. of Karnataka.
3. Approval of SEP-Under Graduate Microbiology - Semester III and Semester IV- Theory and Practical Syllabus for the academic year 2025-26 onwards.

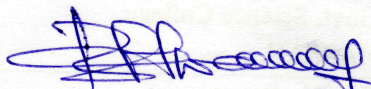
MEMBERS PRESENT ;

1. Dr. Raghavendra M P Dept. of Microbiology Govt. Science College, HASSAN.	External Member	
2. Dr. Dhulappa, Dept. of Microbiology Maharani's Cluster University, BANGALORE-560001	External Member	
3. Dr. Sidde Gowda G S Dept. of Microbiology Sir M V Govt. Science College, Bommanakatte BHADRAVATHI.	Internal Member	
4. Dr. Mukunda S Dept. of Microbiology S.R.N.M.National College of Applied Sciences, NES Campus, SHIMOGA	Internal Member	
5. Dr. Prashith Kekuda T R Dept. of Microbiology S.R.N.M.National College of Applied Sciences, NES Campus, SHIMOGA	Internal Member	
6. Prof. B. Thippeswamy Dept. of Microbiology Kuvempu University SHANKARAGHATTA-577451	Chairman (BOS-UG)	

RESOLUTIONS

1. Board has discussed and approval of Panel of Examiners for the B.Sc., Examination related work of B.Sc., Microbiology for the Academic Year 2025-26.
2. Board has discussed and approved the Ratification of SEP-Curriculum structure for undergraduate programme for 2024-25 onwards, implemented by Govt. of Karnataka.
3. Board has discussed and approval of SEP- Microbiology (UG)- Semester III to Semester IV- Theory and Practical Syllabus for the academic year 2025-26 onwards.

The Chairman thanked all the members for their co-operation.



(Prof. B. Thippeswamy)

Chairman (BOS-UG)

CHAIRPERSON

Board of Studies in Microbiology
Kuvempu University, Jnana Sahyadhi
Shankaraghatta-577 451.



KUVEMPU UNIVERSITY

CHOICE BASED CREDIT SYSTEM (CBCS)

&

CONTINUOUS ASSESSMENT AND GRADING PATTERN (CAGP)

Based

B. Sc. MICROBIOLOGY SYLLABUS

(Case 1: 3 Majors with a General Degree)

2024-25 Onwards

Board of Studies in Microbiology
Department of P.G. Studies & Research in Microbiology
Kuvempu University
Jnanasahyadri, Shankaraghatta- 577451
Shivamogga, Karnataka, INDIA.

Proposed Semester-wise Distribution of the Course Structure

Case 1: 3 Majors with a General Degree for 2024-25 (Onwards)

Major -1; Subject-Microbiology

Sem.	Major-1	Major-2	Major-3	Elective/ Optional	Languages	Compulsory
1	5	5	5	-	Language-1/3 Language-2/3	Compulsory-1 (Constitutional values)-2
2	5	5	5	-	Language-1/3 Language-2/3	Compulsory-2 (Constitutional values)-2
3	5	5	5	Elective-1/2	Language-1/3 Language-2/3	Environmental Science-2
4	5	5	5	Elective-2/2	Language-1/3 Language-2/3	Compulsory-3 (Practical knowledge/skill-1)-2
5	5	5	5	-	-	Compulsory-4 (Practical knowledge/skill-2)-2
6	5	5	5	-	-	Project/Internship) 2
Total	30	30	30	04	24	12
Grand Total Credits - 130						

Curriculum Structure for Undergraduate Programme for 2024-25 (Onwards)
Syllabus to be framed by respective Science Subjects (Departments)
for Microbiology

Sl. No.	Course/Paper Code	Title of the Paper	Subject Category	Teaching Hours/ week	Semester End Exam.	Internal Assessment	Total Marks	Credits	Examination Duration
1	2	3	4	5	6	7	8	9	10
Semester-I									
1	24-MC-I		MC-T	03	80	20	100	03	3 Hrs.
	Practical – I		MC-P	04	40	10	50	02	3 Hrs.
	Total			07	120	30	150	05	---
Semester-II									
2	24-MC-II		MC-T	03	80	20	100	03	3 Hrs.
	Practical – II		MC-P	04	40	10	50	02	3 Hrs.
	Total			07	120	30	150	05	---
Semester-III									
3	24-MC-III		MC-T	03	80	20	100	03	3 Hrs.
	Practical – III		MC-P	04	40	10	50	02	3 Hrs.
	Elective/Optional – I*		EL/O P-I	02	40	10	50	02	2 Hrs.
	Total			09	160	40	200	07	---
Semester-IV									
4	24-MC-IV		MC-T	03	80	20	100	03	3 Hrs.
	Practical – IV		MC-P	04	40	10	50	02	3 Hrs.
	Elective/Optional-II*		EL/O P-II	02	40	10	50	02	2 Hrs.
	Total			09	160	40	200	07	---
Semester-V									
5	24-MC-VA		MC-T	03	80	20	100	03	3 Hrs.
	Practical – V		MC-P	04	40	10	50	02	3 Hrs.
	Total			07	120	30	150	05	---
Semester-VI									
6	24-MC-VIA		MC-T	03	80	20	100	03	3 Hrs.
	Practical – VI		MC-P	04	40	10	50	02	3 Hrs.
	Total			07	120	30	150	05	---
	Grand Total			46	800	200	1000	34	---

MC: Major Course; **MC-T:** Major Course Theory; **MC-P:** Major Course Practical; **EI/Op:** Elective/Optional; **AEDP:** Apprenticeship Embedded Degree Programme. *In Semester-III and Semester-IV elective papers are offered. In Sem III. The Compulsory paper is Environmental Studies. There shall be two elective papers offered in Sem-III and Sem-IV by every major subject offering Departments. Out of this, a student shall choose/select/opt for ONE elective paper in each semester. (i.e Sem-III and Sem-IV) respectively.

Curriculum Structure for Undergraduate Programme for 2024-25

Case 1 : 3 Majors with a General degree in all 6 Semesters

Number of courses and credit course-wise in all semesters

Semester	Major Course (Paper) Major 1	Elective/ Optional	AEDP
01 Theory paper and 01 Practical paper in each Major Subject (T+P)			
I	3+2 = 5		
II	3+2 = 5	---	
III	3+2 = 5	Elective1- 2	
IV	3+2 = 5	Elective2- 2	
V	3+2 = 5	---	
VI	3+2 = 5	---	Project/Internship/ Dissertation-2
Total	30	04	02
Grand Total 36 Credits			

Note:

1. Credit for the three major courses includes theory, practical (skill enhancement course), and tutorial/assignment/survey-based assignment/internship.
2. Practical paper(s) (Compulsory/Skill enhancement course) should provide practical experience which is complimentary to theory major paper(s).
3. Project Work/Dissertation/Internship/Apprenticeship Embedded Degree Programme (AEDP) should also be considered to be part of the curriculum.
4. **Project work/Dissertation/Internship during Semester-VI:** Students for Project work may be allotted as per following formula,

Project allotment to Students

$$= \frac{\text{Total number of students in a three subjects combination}}{\text{Number of subjects in a combination (Three)}}$$

Undergraduate Microbiology Syllabus

(Case 1: 3 Majors with a General Degree)-2024-25

Proposed Semester-Wise Distribution of the Course Structure

Paper code	Paper type	Title of the paper	Credits Assigned	Instructional hours per week
SEMESTER – I				
DSC	Theory-I	Introduction to Microbiology and Microbial Diversity	3	3
DSC	Practical-I	Introduction to Microbiology and Microbial Diversity	2	4
SEMESTER – II				
DSC	Theory-II	Microbial Physiology and Genetics	3	3
DSC	Practical-II	Microbial Physiology and Genetics	2	4
SEMESTER – III				
DSC	Theory-III	Molecular Biology and Environmental Microbiology	3	3
DSC	Practical-III	Molecular Biology and Environmental Microbiology	2	4
ELE	Elective: Theory	Microbiological Quality Control in Industries	2	2
SEMESTER – IV				
DSC	Theory-IV	Genetic Engineering and Agricultural Microbiology	3	3
DSC	Practical-IV	Genetic Engineering and Agricultural Microbiology	2	4
ELE	Elective: Theory	Microbiome	2	2
SEC	Skill-Theory	Microbial and Molecular Techniques	2	2
SEMESTER – V				
DSE	Theory-V	Food and Industrial Microbiology	3	3
DSE	Practical-V	Food and Industrial Microbiology	2	4
SEMESTER – VI				
DSE	Theory-VI	Immunology and Medical Microbiology	3	3
DSE	Practical-VI	Immunology and Medical Microbiology	2	4
		Project/Internship/Dissertation	2	2
			38	50

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	5+5	5	5+5	5	80	40	150
DSE	5+5	5	5+5	5	80	40	150
ELE	5		5		40		50

NOTE;

1. C1 and C2 will be conducted for 10 marks (theory) with 30 minutes duration, 10 marks (lab) with continuous assessment through record valuation and marks reduced to assigned marks.
2. C3 will be conducted for 80 marks (theory) with 3 hours duration, 40 marks (lab) with 3 hours duration.
3. In case of ELE and 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.

Practical Proper Examination I-VI semesters
Duration: 03 hours

- Experimentation (Major & Minor/Spotters) - 30 Marks
 - Viva Voce - 10 Marks
- **Total 40 Marks**

Internal Assessment for Practical Paper I-VI semesters

- Attendance - 05 Marks
 - Record/Journal - 05 Marks
- **Total 10 Marks**

Project Work/Internship during VI semester

- Project work/Dissertation/Internship and preparation of Report - 40 Marks
 - Viva Voce - 10 Marks
- **Total 50 Marks**

Continuous Assessment Programme/Internal Assessment/Formative Assessment
Major Courses

Sl. No.	Continuous Assessment Programme/Internal Assessment	Maximum Marks
01	Two Session Tests with a proper record for assessment (5+5 = 10)	10
02	Assessment of Skill Development activities/Seminars/Group Discussion/ Assignment etc., with proper record	05
03	*Attendance with proper record*	05
Total Marks		20

• **Attendance Marks-breakup**

<75% -	00 Marks
75-80%-	01 Mark
80-85%-	02 Marks
85-90%-	03 Marks
90-95%-	04 Marks
>95% -	05 Marks

Continuous Assessment Programme/Internal Assessment/Formative Assessment
Elective/Optional Papers

Sl. No.	Continuous Assessment Programme/Internal Assessment	Maximum Marks
01	Two Session Tests with proper record for assessment (2+2 = 4)	04
02	Assessment of Skill Development activities/Seminars/Group Discussion/ Assignment etc., with proper record	03
03	*Attendance with proper record*	03
Total Marks		10

• **Attendance Marks-breakup**

<75% -	00 Marks
75-80%-	01 Mark
85-90%-	02 Marks
90-100%-	03 Marks

Under Graduate Microbiology

THIRD SEMESTER

Course Learning Objectives ;

- To impart knowledge about chemical basis of genetic material
- To understand regulation of gene expression
- To demonstrate air samplers to trap airborne microbes
- To study soil microflora and their impact on environment
- To discuss the scope of Aquatic and Sewage Microbiology

Course Outcomes ; The students will be able to

- Understand the chemical basis of heredity and DNA replication
- Gain knowledge about protein synthesis and gene regulation
- Get expertised in handling air samplers and understand the role of soil microflora
- Develop knowledge about microbiological analysis of water and wastewater

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. Noncoding RNAs and their importance.

DNA replication: Definition and modes. Meselson-Stahl experiment. Enzymes and proteins involved in DNA replication. General mechanism of semi-conservative replication. Θ (theta), linear and rolling circle mode of replication.

Transcription: Transcription unit- concept of gene, non-transcribing regions, 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, maturation and secretion. 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. Air microflora 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, Verticle cylinder and Hirst spore trap. Space Microbiology.

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. Bioleaching.

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.

THIRD SEMESTER**DSC-3; 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. Estimation of RNA by Orcinol method.
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 H₂S 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 and oxidation pond 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
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8. Freifelder's Essentials of Molecular Biology. George M Malacinski, 4th 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.
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18. Rheinhermer, G. (1986). Aquatic Microbiology Jhon Wiely 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.

THIRD SEMESTER

ELE-1: MICROBIOLOGICAL QUALITY CONTROL IN INDUSTRIES

ELECTIVE-1

32 (2hrs/week)

Unit I: Biohazards and Microbiological quality analysis of Air

16 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. Biosafety levels- BSL1, BSL-2, BSL-3 and BSL4. Discarding biohazardous waste- Methodology of disinfection, autoclaving and incineration.

Microbiological quality analysis of Air: Bioaerosols. Airborne microorganisms (bacteria, viruses, fungi) and their impact on human health and environment. Significance of air microflora in food and pharma industries and operation theatres. Bioaerosol sampling, identification characteristics of bioaerosols. Bioaerosols inactivation mechanisms- UV light, desiccation, incineration.

Unit II: Microbiological quality analysis of Food and Water

16 hrs.

Culturing Microorganisms of Importance in Food and Water: SOP for water and food sampling. Culture media to detect specific microorganisms- XLD agar, Salmonella Shigella agar, Mannitol salt agar, EMB agar, McConkey agar and Saboraud agar. Methods of analysis for foods and water: Aerobic Plate Count (APC), Most Probable Numbers (MPN). Immunological and molecular methods of detection of microbial contaminants in food and water.

Food safety and standards: Introduction to food safety. Role of microbiologist in food industries. Food Safety and Standards Act, 2006. 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 Water A 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. Harrigan, W. F. (1998) Laboratory Methods in Food Microbiology, 3rd ed. Academic Press.
6. Jay, J. M., Loessner, M. J., Golden, D. A. (2005). Modern Food Microbiology, 7th edition. Springer.
7. Maier, R. M., Pepper, I. L. and Gerba, C. P. (2009). Environmental Microbiology. 2nd edition, Academic Press.

FOURTH SEMESTER

Course Learning Objectives :

- To discuss molecular tools in gene cloning and cloning vectors
- To gain knowledge about gene screening and application of recombinant technology
- To identify various microbial inoculants and their role in soil fertility
- To explore biocontrol agents in agriculture
- To study plant diseases caused by bacteria, fungi and viruses

Course Outcomes : The students will be able to

- Understand basic concepts of recombinant technology
- Develop knowledge about various techniques used in gene screening
- Get expertised in production and uses of biofertilizers and biopesticides
- Become skilled in identifying plant diseases and their management

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. RFLP and DNA finger printing. DNA hybridization 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 – types and applications.

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*, cyanobacterial and VAM inoculants.

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, Koleroga (fruit rot) of Arecanut; bacteria- citrus canker, Sandalwood spike; viruses – Bean mosaic and Papaya ring spot; and viroid (Potato spindle tuber disease). Post-harvest pathology.

FOURTH SEMESTER

DSC-4: 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- Koleroga of Arecanut 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.
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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.
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15. Wiley, J. M., Sherwood, L. M. and Woolverton, C. J. (2008). Prescott, Harley and Klein's Microbiology. McGraw Hill Higher Education.

FOURTH SEMESTER

ELE-2: MICROBIOME

ELECTIVE-2

32 (2hrs./week)

Unit I: Microbiome

16 hrs.

Introduction to Microbiome- Definition and scope. 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.

Plant Microbiome: Basics of plant microbiome. Dynamic relationships between plant and microorganisms. Use of plant microbiome interaction for nutrients uptake, nitrogen fixation, pollutants cleaning and soils/plants health improvement. Current techniques and future research about plant microbiome.

Unit II: Animal Microbiome

16 hrs.

Animal Microbiome: 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 factors influencing the rumen microbiota. Rumen microbiome and methanogenesis.

Human Microbiome: Introduction to the human microbiome. The holobiont theory of evolution. Pre and post-natal microbiome. Dysbiosis and the gut microbiome. Antibiotics and the human microbiome. Diet 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, 304 pp.
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.

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. IBSC.

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 cultures. Morphological characterization of bacteria.

Unit II: Molecular Techniques

16 hrs.

Centrifugation and Chromatography: Centrifugation – Principle, types and applications. Chromatographic techniques - Principles and application of Partition, adsorption, ion exchange, exclusion and affinity chromatography.

Spectrophotometry and Electrophoresis: Spectrophotometry - Principle and applications of UV and visible spectrophotometer. Electrophoretic technique: Components, working principle and applications of agarose and polyacrylamide gel electrophoresis-.

Radiobiology: Radioactivity, radioisotopes. Radioisotope dilution 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. John Wiley & Sons Inc. New York, Cambridge University Press.
4. Colin A. Ramsden (2014). "Analytical Molecular Biology". Oxford University Press.
5. Cowan and Steel's Manual for the Identification of Medical Bacteria. G. I. Barrow (Editor), R. K. A. Feltham (Editor) 3rd Edition. 2004.
6. John M. Walker and Ralph Rapley (2014). "Molecular Biomethods Handbook". Humana Press.
7. Maheswari, D. K. (2010). Practical Microbiology. S Chand publications
8. Michael Lufaso (2016). "Laboratory Skills for Science and Medicine: An Introduction". CRC Press.
9. Murphy, D. B. (2001). Fundamental of Light Microscopy & Electron Imaging. 1st Edition. Wiley-Liss.
10. Plummer, D. T. (1987). An Introduction to Practical Biochemistry. McGraw Hill Publication.
11. Pranav Kumar (2016). Fundamentals and Techniques of Biophysics and Molecular Biology
12. Prescott, M. J., Harley, J. P. and Klein, D. A. (2002). Microbiology. 5th Edition WCB McGrawHill, New York,
13. Wilson and Walker (2000). Principles and Techniques in Practical Biochemistry. 5th Edition.

SCHEME OF PRACTICAL EXAMINATION

THIRD 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. 08 Marks

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

(Demonstration- 4 Marks, Principle and Procedure- 3 Marks and Result- 1 Mark)

II. Perform or demonstrate the experiment B giving principle and procedure. Record the result. 08 Marks

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

(Demonstration- 4 Marks, Principle and Procedure- 3 Marks and Result- 1 Mark)

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 / H₂S strip test)

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

IV. Write critical notes on D, E and F. 3x3=09 Marks

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

(Identification- 1 Mark and Critical comments- 2 marks)

V. Viva-voce

10 Marks

QUESTION PAPER PATTERN OF PRACTICAL EXAMINATION

THIRD 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. | 08 Marks |
| II. Perform or demonstrate the experiment B giving principle and procedure. Record the result. | 08 Marks |
| III. Conduct or identify the test C. Record and interpret the result. | 05 Marks |
| IV. Write critical notes on D, E and F | 3x3=09 Marks |
| V. Viva-voce | 10 Marks |

SCHEME OF PRACTICAL EXAMINATION

FOURTH SEMESTER

DSC-4: GENETIC ENGINEERING AND AGRICULTURAL MICROBIOLOGY

Duration : 3 hours

Max. Marks : 40

- I. Demonstration or perform the experiment A giving principle and procedure. Record the result. 08 Marks**
(Visualization of DNA by agarose gel electrophoresis / Preparation of master and replica plate / Blue-white screening of recombinants)
(Demonstration- 4 Marks, Principle and Procedure- 3 Marks and Result- 1 Mark)
- II. Perform or demonstrate the experiment B giving principle and procedure. Record the result. 08 Marks**
(Antagonism between microorganisms / Seed health testing by standard blotter method / Gram staining of citrus canker specimen)
(Demonstration- 4 Marks, Principle and Procedure- 3 Marks and Result- 1 Mark)
- III. Identify the organism in the materials C with labeled diagrams and reasons. 05 Marks**
(*Anabaena* from *Azolla* / Tikka disease of Groundnut / Koleroga of Arecanut)
(Identification- 1 Mark and Labelled diagram with reasons- 4 Marks)
- IV. Write critical notes on D, E and F. 3x3=09 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 comments- 2 marks)
- V. Viva-voce 10 Marks**

QUESTION PAPER PATTERN OF PRACTICAL EXAMINATION

FOURTH 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. 08 Marks**
- II. Perform or demonstrate the experiment B giving principle and procedure. Record the result. 08 Marks**
- III. Identify the organism in the materials C with labeled diagrams and reasons. 05 Marks**
- IV. Write critical notes on D, E and F 3x3=09 Marks**
- V. Viva-voce 10 Marks**

THEORY EXAMINATION QUESTION PAPER PATTERN FOR MAJOR SUBJECTS

(Semesters I –VI)

B.Sc. Degree Examination; 2024-25

(Semester Scheme; New Syllabus: 2024-25 onwards)

SUBJECT: MICROBIOLOGY

Paper:

Paper Code:

Time: 3 Hours

Max. Marks: 80

Instructions to candidates:

- 1) All sections are compulsory
- 2) Draw neat and labelled diagrams wherever necessary.

SECTION-A

1. Answer **All** the following questions:

(2×10=20)

- a)
- b)
- c)
- d)
- e)
- f)
- g)
- h)
- i)
- j)

SECTION-B

Answer any **Six** of the following:

(5×6=30)

- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.

SECTION -C

Answer any **Three** of the following:

(10×3=30)

10. From Unit-I
11. From Unit-II
12. From Unit-III
13. From Unit-IV

THEORY EXAMINATION QUESTION PAPER PATTERN FOR ELECTIVE/OPTIONAL PAPERS

(Semesters III & IV)

B.Sc. Degree Examination 2024-25

(Semester Scheme; New Syllabus: 2024-25 onwards)

SUBJECT: MICROBIOLOGY

Paper –ELECTIVE/OPTIONAL/SKILL OR PRACTICAL

Paper Code:

Time: 2 Hours

Max. Marks: 40

Instructions to candidates:

- 1) All sections are compulsory
- 2) Draw neat and labelled diagrams wherever necessary.

SECTION-A

Answer **all** the following questions:

(2×5=10)

- 1.
- 2.
- 3.
- 4.
- 5.

SECTION-B

Answer **any SIX** of the following:

(5×6=30)

- 6.
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.
- 13.
