ADIKAVI SHRI MAHARISHI VALMIKI UNIVERSITY, RAICHUR

B. Sc. Microbiology

SYLLABUS

With Effect from 2024-25

DISCIPLINE SPECIFIC CORE COURSE (DSC) FOR SEM III and VI,

SKILL ENHANCEMENT COURSE (SEC) FOR SEM IV/V/VI and ELECTIVE COURSES FOR SEM V AND VI

AS PER NEP (Revised):2024

B. Sc. Semester–IV

Discipline Specific Course (DSC)-Microbiology

Course Title:- Environmental and Agricultural Microbiology

Course Code:-C4MCB1T1

Type of Course	Theory /Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours /Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSC-7	**Theory**	**04**	**04**	**60hrs.**	**3hrs.**	**20**	**80**	**100**

Course Outcomes (COs): At the end of the course students will be able to:

CO 1 : Develop thorough knowledge and understanding of concepts of Microbiology of Air, water and soil, Bioremediation and Bioleaching of minerals.

CO 2 : Students will become efficient in Agricultural and soil microbiology.

CO 3 : Student get knowledge of Biofertilizers production and marketing.

CO 4: Students will learn microbes' importance in agriculture sustainability, microbes in plant diseases and biopesticides.

Unit	Title: Environmental and Agricultural Microbiology	60 hrs/ Sem
Unit I	**Microbiology of air** Microbes and atmosphere: Atmospheric layers, air as habitat for microbes, air microflora of indoor and outdoor environment, space microbes, factors affecting air microflora, significance and management of airborne microbes. Techniques of trapping airborne microorganisms: Gravity slide, Petri plate exposure, liquid impingement, sieve device and filtration. Air borne diseases: allergens, pathogens, significance of microorganisms in air. Control of air borne microorganisms. **(7 hrs.)** **Microbiology of water** **Sources of water:** surface and ground water and their microflora. Water as a habitat for microbes. Water pollution - sources, water borne diseases-viral (Jaundice), bacterial (Cholera) and protozoan (amoebiasis), biological indicators of water pollution. Determination of sanitary quality of water: SPC tests for coliform and *E. coli.* MPN. IMViC tests, membrane filter technique. Water purification in municipal water supply. **(8 hrs.)**	15 hrs.
Unit II	**Microbiology of waste water** Source of waste water - domestic, agricultural and industrial, physical, chemical and microbiological characteristics of waste water. Waste water treatment: Single dwelling unit - Septic tank; municipal waste water treatment- Primary (Screening, coagulation and Sedimentation). Secondary (trickling filter, activated sludge process, Osmosis, oxidation pond), Tertiary (reverse ion exchange method and dialysis), reclamation of waste water and solid waste recycling. Waste as Resource (organic compost): Biogas production and composting. **(8 hrs.)**	15 hrs

	Bioremediation and Bioleaching: Introduction, types, mechanism, scope and applications of Bioremediation. Factors affecting the microbes in heavy metal tolerance, Different microbial groups in bioremediation of environment pollution. Biodegradation of Petroleum (Hydrocarbons), pesticides (2,4-D and DDT), different microbial groups in bioremediation of environment. Role of Biosurfactants in bioremediation of pollutants. **Bioleaching:** Scope, organisms involved, economic importance, mechanism of bioleaching of Cu and Fe. **(7 hrs.)**	
Unit III	**Microbiology of soil** Introduction: Type, soil profile, physical and chemical characters. Soil as habitat for microbes. Soil Microorganisms: Bacteria, fungi, actinomycetes. algae, protozoa and viruses. Role of Microbes in soil process: Biogeochemical cycles - Carbon, Nitrogen, Sulphur and Phosphorous. Biodegradation: Pectin. Cellulose and lignin. Rhizosphere Microorganisms: Rhizosphere and rhizoplane, Interactions among microorganisms -Neutralism, Mutualism, Commensalism. Antagonism and Parasitism. Plant-microbe interaction: Mycorrhizae. **(8 hrs.)** **Microorganisms in Agriculture** **Bio-fertilizers:** Types (Bacterial, fungal, phosphate solubilizers. BGA. Plants-Azolla*)*. **Mechanism of Nitrogen fixation:** Phosphate solubilizing and Cellulolytic micro-organisms, Mass production, mode of applications, advantages and limitations of bacterial inoculants *(Rhizobium, Azotobacter, Azospirullum* and Cyanobacteria). **(7 hrs.)**	15 hrs.
Unit IV	**Microbes as plant pathogens** A brief account of the causative agent. Symptoms and control of the following plant diseases: Fungal *(Puccinia, Plasmopara, Cercospora, Pyricularia)* Bacterial *(Xanlhomonas oryzae),* Mycoplasma - Sandal spike. Grassy shoot. Viruses (TMV. Tomato leaf curl). Brief account of post-harvest pathology and Integrated Pest Management. **(12 hrs.)** **Bio-pesticides:** Types (Bacteria- *Bacillus thuringienes,* viral- NPV. *Fungal (Trichoderma),* mode of action, factors influencing and target pests. **(3 hrs.)**	15 hrs.

Recommended books:
References:

1. Alexander, M. (2019). *Introduction to soil microbiology* (6th ed.). John Wiley & Sons.
2. Atlas, R. M., & Bartha, R. (2021). *Microbial ecology: Fundamentals and applications* (4th ed.). Benjamin Cummings.
3. Brock, T. D. (2015). *Principles of microbial ecology* (3rd ed.). Prentice Hall.
4. Colwell, R. R. (2012). *Microbial diversity* (2nd ed.). Academic Press.
5. Grant, W. D., & Long, P. E. (2018). *Environmental microbiology* (2nd ed.). Thomson Litho Ltd.
6. Hurst, C. J. (2020). *Environmental microbiology* (3rd ed.). ASM Press.
7. Mehrotra, R. S. (2017). *Plant pathology* (5th ed.). Tata McGraw Hill.
8. Pelczar, M. J., Chan, E. C. S., & Krieg, N. R. (2019). *Microbiology* (6th ed.). McGraw Hill.

9. Mitchell, R. (2018). *Introduction to environmental microbiology* (4th ed.). Prentice Hall.
10. Powar, C. B., & Daginwala, H. F. (2015). *General microbiology* (Vol. 1, 4th ed.). Himalaya Publishing House.
11. Powar, C. B., & Daginwala, H. F. (2015). *General microbiology* (Vol. 2, 4th ed.). Himalaya Publishing House.
12. Prescott, L. M., Harley, J. P., & Klein, D. A. (2021). *Microbiology* (11th ed.). McGraw Hill.
13. Mitchell, R. (2020). *Environmental microbiology* (4th ed.). Wiley.
14. Rangaswamy, G. (2019). *Diseases of crop plants in India* (4th ed.). Prentice Hall of India.
15. Rangaswamy, G., & Bagyaraj, D. J. (2017). *Agricultural microbiology* (3rd ed.). Prentice Hall of India.
16. Rao, M. N., & Datta, A. K. (2018). *Wastewater treatment* (3rd ed.). Oxford & IBH.
17. Rheinheimer, G. (2016). *Aquatic microbiology* (5th ed.). John Wiley & Sons.
18. Salle, A. J. (2019). *Fundamental principles of bacteriology* (10th ed.). Tata McGraw Hill.
19. Singh, D. P., & Dwivedi, S. K. (2018). *Environmental microbiology and biotechnology* (2nd ed.). New Age Industrial Publishers.
20. Stanier, R. Y., & Ingraham, J. L. (2019). *General microbiology* (6th ed.). Prentice Hall of India.
21. Stewart, W. D. P. (2017). *Nitrogen fixation in plants* (4th ed.). The Alhione Press.
22. Subba Rao, N. S. (2019). *Soil microorganisms and plant growth* (5th ed.). Oxford & IBH.
23. Subba Rao, N. S. (2018). *Biofertilizers in agriculture* (3rd ed.). Oxford & IBH.

Formative Assessment for Theory	
Assessment Occasion / type	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Total	**20 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester–IV
Discipline Specific Course (DSC)
Practical: Environmental and Agricultural Microbiology

Course Title: Environmental and Agricultural Microbiology
Course Code: C4MCB1P1

Type of Course	Theory /Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours /Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSC-8	**Practical**	**02**	**04**	**56 hrs.**	**3hrs.**	**10**	**40**	**50**

Course Outcomes (COs): At the end of the course students will be able to:

CO 1 : Develop thorough knowledge and understanding of Experiments in Microbiology of Air, water and soil.

CO 2: Students will become efficient in managerial skills in water microbiological analysis chemical and biological tests.

CO 3: Able to employ analytical reasoning, problems solving, interpretation and documentation of laboratory experiments at a level suitable to succeed at an entry- level position in Microbiology.

CO 4: Students will get expertise in Biofertilizer and biopesticides production, techniques to detect plant pathogens from diseased plants.

Practical: Environmental and Agricultural Microbiology
(4 hrs./week) (Minimum 12 experiments)

1. Isolation of microorganisms from soil, air and water.
2. Isolation and enumeration of microorganisms from different water samples.
3. MPN tests and Membrane filtration Techniques for Coliform and E. coli from potable water samples.
   Rapid methods to detect Coliform and E. coli from drinking water samples.
4. Estimation of TSS (Total Suspended Solids) and TDS (Total Dissolved Solids) in sewage samples.
5. Estimation of dissolved oxygen, BOD, COD and chloride.
6. Bioremediation of industrial wastes (Soil and Water) by using indigenous microbes.
7. Isolation and enumeration of bacteria and fungi from Rhizosphere and Rhizoplane. Study of Antagonism between soil microorganisms by plate method.
8. Isolation of *Rhizobum* using yeast extract Mannitol Agar and Isolation of *Azotobacter* using Ashby's Mannitol Agar from soil.
9. Study of Rhizobium from Legume root nodules through gram staining.
10. Mass of cultivation of Rhizobium Biofertilizer (liquid/solid) using carrier material.
11. Isolation of Actinomycetes from soil using different agar medias.
12. Demonstration of water purification process: Flocculator, Clarifier, Sand filter, back wash chlorinometre and chloroscope), sewage treatment plants - Trickling filter, Imhoff tank, Septic tank and sewage treatment
13. Demonstration of air samplers – vertical cylinder spore trap. Rotorod samples, Hirst spore trap. Anderson samples liquid impingement method (Bead Bubbler).
14. Plant Pathology: Study of plant pathogens (Two diseases each from Bacteria, Fungi and Virus). Demonstration of caking of grains.
15. Visit to Municipal water treatment/water treatment plant /sewage treatment plant. Report should be written and submitted along with practical record.


Deputy Registrar Office (Academic)
RAICHUR
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