B.Sc Semester 4

Semester: 4	
Course : Microbiology	
Paper Title: Agricultural Microbiology	
Paper code: S2MB230411P	**Credits:**
Hours/week : 4	
Category: Core/MDC/SEC/VAC : SEC	
Theory / Practical / Composite : practical	
No of Modules : No modules	

Course Overview: The course is designed on practical hands-on experience handling different microbial cultures and their application in the area of agricultural microbiology. It deals with the isolation of microorganisms, their cultivation and propagation and mass production and application to agricultural crops of importance. The estimation of NPK and micronutrients of soil and rectification using soil microbes. The general account of microbes as bioinsecticides and their advantage over synthetic pesticides.

Course Outcome:

1. **Remember**: to remember the different types of biofertilizer, their application in different types of agricultural crops. To remember the classes of nitrogen fixers, phosphate and potassium solubilizing microbes**.**
2. **Understand:** to understand the basic differences between biofertilizers and chemical fertilizers. Apply the knowledge of free living and symbiotic nitrogen fixers, phosphate and potassium solubilizing microbes and their usage in the field of agricultural microbiology.
3. **Apply:** To apply and understand the knowledge of biofertilizers in the field of mass production of biofertilizers and their application in the field trials against agronomic crops of economic importance.
4. **Analyze:** To study, understand and examine mechanisms of biofertilizers and their benefit on agricultural crops. To compare the differences on the quality and quantity of agronomic traits between agricultural crops raised by biofertilizers and chemical fertilizers.
5. **Evaluate**: To examine, develop indigenous biofertilizers, consortium of biofertilizers and their application in fields to restore the NPK content of soil and their application to agricultural crops to evaluate and improve their economic traits.
6. **Create:** To design, develop consortium of biofertilizers and their lab to land transfer and evaluation of their application in the field of agricultural microbiology.

Prerequisites: ***Basic knowledge about any prior course***

SYLLABUS

UNIT/Module	CONTENT	HOURS or NUMBER OF CLASSES	CO Mapping	COGNITIVE LEVEL
I.	**Introduction to Agricultural Microbiology.**	**2**	**CO1, CO2**	**K1, K2**

II.	**General account of the microbes used as biofertilizers for various crop plants and their advantages over chemical fertilizers.**	**2**	**CO1, CO2**	**K1, K2**
III.	**Symbiotic N2 fixers: Cyanobacteria, Azolla - Isolation, characterization, mass multiplication, Role in rice cultivation and role in arsenic bioremediation.**	**12**	**CO1, CO2, CO3, CO4**	**K1, K2, K3, K4**
IV.	**Estimation of NPK and micronutrients in soil. Rectification/Restoration of soil fertility using residual microbes.**	**12**	**CO2, CO3, CO4, CO5**	**K2, K3, K4, K5**
V.	**Importance of mycorrizal inoculum, types of mycorrhizae and associated plants, mass inoculum production of VAM, field applications of Ectomycorrhizae and VAM.**	**4**	**CO2, CO3, CO4, CO5**	**K2, K3, K4, K5**
VI.	**Free living Azospirillum, Azotobacter - free isolation, characteristics, mass inoculums production and field application.**	**4**	**CO2, CO3, CO4, CO5**	**K2, K3, K4, K5**
VII.	**Phosphate and potassium solubilizing microbes - Isolation, characterization, mass inoculum production, field application.**	**4**	**CO1, CO2, CO3, CO4, CO5**	**K1, K2, K3, K4, K5**
VIII.	**General account of microbes used as bioinsecticides and their advantages over synthetic pesticides. Testing of commercial formulation of biopesticide containing *Bacillus thuringiensis*, *Pseudomonas fluorescence*, *Trichoderma viridae* and development of indigenous/lab based formulations.**	**8**	**CO2, CO3, CO4, CO5, CO6**	**K2, K3, K4, K5, K6**

Text Books

1. **1. Kannaiyan, S. (2003). Bioetchnology of Biofertilizers, CHIPS,Texas.**
2. **Mahendra K. Rai (2005). Hand book of Microbial biofertilizers, The Haworth Press, Inc. New York.**
3. **Reddy, S.M. et. al. (2002). Bioinoculants for sustainable agriculture and forestry, Scientific Publishers.**
4. **Aggarwal SK (2005) Advanced Environmental Biotechnology, APH publication.**

Suggested readings
1. **Subba Rao N.S (1995) Soil microorganisms and plant growth Oxford and IBH publishing co. Pvt. Ltd. NewDelhi.** 2. **Saleem F and Shakoori AR (2012) Development of Bioinsecticide, Lap Lambert Academic Publishing GmbH KG**
Web Resources
1.
2.
3.
4.
Evaluation Theory CA:40 End sem:7 Attendance:3
Paper Structure for Theory Semester Exam Module : NA

Course outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive levels
CO1	Remember: Define, identify, recognize the nature, structure and function of microbial diversity existing in nature and understanding the microbial diversity in relation to its environment.	K1
CO2	Understand: To understand microbial interactions from the foundations of microbial communities, shaping the structure and function of communities and their different types of interactions i.e. both positive and negative.	K2
CO3	Apply: To understand the microbial interactions occurring in biogeochemical cycles, the diverse microbial metabolism, microbial role in nutrient recycling, maintaining a role in elemental flux thereby contributing to ecosystem dynamics.	K3
CO4	Analyze: Understanding the role of extremophiles, their nature, classification based on habitat, physiological and biochemical adaptation, and their application in industries.	K4
CO5	Evaluate: Remembering the core concepts of microbial diversity, their application in waste management systems (solid and liquid), physical, chemical and biological methods of waste treatment, engineering principles of waste treatment plant and their eco-friendly solutions.	K5

CO6	Create: To create and develop the foundation principles behind the waste management systems, concepts of indicator bacteria, formulate core concepts in terms of physical, chemical and microbiological parameters of potable water. Develop microbiological tests to study indicator bacteria.	K6