

Programme: M.Sc. (Microbiology)

Course Code: MIO 120

Title of the Course: AGRICULTURE MICROBIOLOGY [T]

Number of Credits: 3

Effective from Academic Year: 2018-19

Prerequisites	It is assumed that the students have knowledge about microorganisms and their diversity.	
Objective:	The course deals with the information about Inter-relationship of soil and microorganisms, different groups of beneficial microorganisms in agriculture, microbes as biofertilizer, plant pathogen and biocontrol agent.	
Content:		
1.	Soil Microbiology	(12)
A.	Terrestrial Ecosystem, Pyramids and Econiches.	
B.	Types of Soil, soil Profile, Physico-Chemical Characteristics.	
C.	Suitability of soil for agriculture.	
D.	Soil Enzymes and significance.	
E.	Influence of microbial metabolism on soil chemistry & humus formation and its significance (humic and fulvic acids).	
F.	Factors influencing bacterial survival in soils: Biotic & Abiotic.	
G.	Establishment of microbial inoculant.	
H.	Rhizosphere and Rhizoplane Microflora.	
I.	Plant growth promoting Rhizobacteria, nitrogen fixation, phosphate mobilization and biocontrol of plant pathogens.	
2.	Beneficiary Microorganisms to plants	(12)
A.	Mycorrhiza – Ectomycorrhiza, Endomycorrhiza, VAM structure & significance.	
B.	Plant growth promoting hormones from microbes viz. bacteria and fungi & their significance.	
C.	Nitrogen-fixing microbes - Biochemistry and Genetics of free living and symbiotic nitrogen fixers viz. <i>Azotobacter vinelandii</i> , <i>Rhizobium</i> . Significance of <i>nif</i> H, D, K, A, L, nod, nodulin and <i>fix</i> genes in microbial nitrogen fixation.	
D.	Biofertilizers: An Overview.	
(i)	free living soil microbes fixing N ₂ (<i>Azotobacter</i> , <i>Azospirillum</i>).	
(ii)	<i>Rhizobium</i> / <i>Azorhizobium</i> , in symbiotic association with leguminous plants.	
(iii)	Free living cyanobacteria- <i>Nostoc</i> .	
(iv)	Associative cyanobacteria (symbionts)- <i>Anabaena azollae</i>	
(v)	<i>Azolla</i> as Biofertilizer.	
(vi)	Compost as Biofertilizer.	

E.	Microbial Pesticides – (Biocontrol agents for agriculturally important crop plants) – Development and their significance; Source Organisms: Bacteria- <i>Bacillus thuringiensis</i> , Bt based commercial products, other Bacilli producing pesticides; Fungi— <i>Beauveria bassiana</i> , Viruses-Baculoviruses for insect pest control.	
3.		(12)
	Plant Pathogens (bacterial, fungal, viral, viroid).	
	Virulence in plant pathogens - biochemical and genetic basis of virulence, toxins as virulence factors	
	Plant defense responses - anatomical changes, phytoalexins, alkaloids and other biocontrol molecules	
	Pathogen control - viral proteins in controlling viral diseases, mycoviruses against fungal plant pathogens, RNA and antisense RNA technology in disease control	
Pedagogy:	Lectures/tutorials/assignments/self-study	
References/ Readings	Alexander, M., Introduction to Soil Microbiology, Wiley.	
	Dadarwal, K. R., Biotechnological Approaches in Soil microorganisms for sustainable crop production, Scientific Publishers.	
	Subba Rao, N. S., Advances in Agricultural Microbiology, Oxford & IBH Publishers.	
	Carr, N. G. and Whitton, B. A., The Biology of Blue-green algae, University of California Press.	
	Mahanta, K. C., Fundamentals of Agricultural Microbiology, Oxford & IBH Publishers.	
	Veeresh, G. K. and Rajagopal, D., Applied Soil Biology and Ecology, Oxford & IBH Publishing Company Pvt. Limited.	
	Somani, L. L., Biofertilizers in Indian Agriculture, Concept Publishing Company.	
	Subba Rao, N. S., Biofertilizers in Agriculture and Forestry, International Science Publishers.	
	Bilgrami K. S. (1987) Plant Microbe Interactions, Proceedings of Focal Theme Symposium, Indian Science Congress Association, Narendra Publishing House.	
	Madigan, M. T., Martinko, J. M., Bender, K. S., Buckley, D. H. and Stahl, D. A., Brock Biology of Microorganisms, Pearson Education Limited.	
	Kumar, H. D., Modern Concepts of Microbiology, Vikas Publishing House Pvt. Ltd.	
Learning Outcomes	<ol style="list-style-type: none"> 1. Apply the knowledge of soil chemistry and significant biochemical processes of microbes to improve agricultural practices. 2. Apply the understanding about genetics of advantageous microorganisms to genetically modify and develop improved crops. 	