

Semester	4		
Course Code:	MIBI 22534		
Course Name:	Fundamentals and Applications of Environmental and Agricultural Microbiology		
Credit Value:	4		
Core/Optional	Core		
Hourly Breakdown	Theory	Practical	Independent Learning
	60 hrs	-	140 hrs
Course Aim/Intended Learning Outcomes:			
Upon successful completion of this course student will be able to;			
<ul style="list-style-type: none"> • Explain the distribution of microbes in several different environments, including water, sediments, soil & air, • Understand microbial ecology with respect to microbial interactions, succession, and community development, • Explain abiotic and biotic factors influence the distribution of microbes in air, water and soil, • Illustrate the ecological importance of microbes and their function in natural ecosystems, • Discuss water purification techniques and indicator microorganisms used for microbiological quality of water, • Demonstrate knowledge in solid and liquid waste management, • Apply fundamental principles of wastewater treatment, • Understand the contemporary issues associated with environmental microbiology, • Describe how pathogens attack plants, • Understand the plant defense mechanisms against pathogens, • Explain environmental effects on the development of plant disease and • Discuss the methods used to prevent and control of plant diseases. 			
Course Content:			
Environmental Microbiology:			
<p><i>Introduction:</i> Significance. Historical perspective. <i>Microbial Ecology:</i> Place and the significance of microorganisms in the ecosystem. Population selection within microbial communities. Succession within microbial communities. Ecological role of microorganisms. Physiological state of microorganisms in ecosystems. Microbial interactions: Interactions among microbial populations, between microbes and plants, between microbes and animals.</p> <p><i>Aeromicrobiology:</i> Nature of bioaerosols, Airborne pathogens, Aeromicrobiological pathway, Microbial survival in the air, Extramural Aeromicrobiology. Intramural Aeromicrobiology, Bioaerosol control. Biosafety in the laboratory. <i>Aquatic Microbiology:</i> Aquatic environment as a microbial habitat. Fresh, marine, and brackish water environments. Microbiological quality control of water, Water related illnesses, Microbial indication of water quality. Treatment and distribution of drinking water. Microbiology of wastewater treatment and disposal (industrial and domestic). <i>Bioremediation:</i> Treatment of organic and inorganic waste. Different methods available.</p>			
Agricultural Microbiology:			
<p><i>Plant diseases, Plant Pathogens and the Disease Triangle:</i> Normal biochemical and physiological functions of plants. Definition of plant disease. Primary causes of diseases, Biotic Causes of diseases, Types of Parasites. Pathogens, Disease Triangle. Diagnosis and features of disease. <i>Koch's Postulates and Disease Cycle:</i> Koch's Postulates, Disease Cycle – composition of pathogen life cycle and interaction with the host. <i>Different types of plant pathogens:</i> Fungal and Pseudo-fungal pathogens, Bacterial and mollicutes, Viruses and viroids. Methods of pathogens attacking plants, Adhesion, Penetration, Infection, Pathogenicity Factors. <i>Plant defense against pathogens:</i> Defense mechanisms, Pre-existing and Induced mechanisms. <i>Gene for Gene Hypothesis.</i> <i>Plant Disease Management:</i> Integrated Pest Management, Agronomical practices, Disease resistant varieties, Biological control agents, Eradication, Application of pesticides. <i>Breeding and Selection of disease resistant plants:</i> Vertical and Horizontal resistance, Comparison of the types of resistances, Types of breeding of plants, Inoculation of the progeny, Scale of resistance. <i>Soil microbiology:</i> Diversity of microbial habitats, Physical, chemical and biological aspects of soil structure. Methods of studying soil microorganisms. Environmental and agricultural significance of soil microorganisms.</p>			
Teaching /Learning Methods:			
A combination of lectures, computer assisted learning, assignments, and small group discussions			
Assessment Strategy: Continuous assessment and end of the course unit examination.			

Continuous Assessment 20%	Final Assessment 80%		
Details: Quiz: 10% Group work: 10%	Theory (%) 80	Practical (%) -	Other (%) -
<p>Recommended Reading:</p> <ul style="list-style-type: none"> • Atlas, R.M., (1998). <i>Microbial ecology: fundamentals and applications</i>. Pearson Education India. • Pepper, I.L., Gerba, C.P., Gentry, T.J. and Maier, R.M. eds., (2011). <i>Environmental microbiology</i>. Academic press. • Bitton, G., (2005). <i>Wastewater microbiology</i>. John Wiley & Sons. • Paul, E.A. (2014). <i>Soil Microbiology, Ecology and Biochemistry</i>, Academic Press • Sylvia D.M., Fuhrmann, J.J., Hartel, P., Zuberer, D. A. (Eds.). (2005). <i>Principles and Applications of Soil Microbiology</i>, 2nd edition. Upper Saddle River, NJ: Pearson Printice Hall. • Agrios, G. N. (2005) <i>Plant Pathology</i>, 5th Edition, Elsevier Academic Press. 			