

<p style="text-align: center;"><b>SEMESTER – V</b></p> <p style="text-align: center;"><b>PAPER I : ENVIRONMENTAL MICROBIOLOGY</b></p> <p style="text-align: center;"><b>Total hours allotted: 70</b></p>	<p style="text-align: center;"><b>60 Hrs</b></p>	<p style="text-align: center;">Staff</p>
<p><b>1.Introduction</b> Soil, water and air as habitats for microorganisms and concept of environment, microbial populations in the above habitats</p>	<p style="text-align: center;">3 Hrs</p>	<p style="text-align: center;">KH</p>
<p><b>2. Microbiology of air</b> a) <b>Microbes and atmosphere:</b> Atmospheric layers, sources of microorganisms, air microflora of indoor and outdoor environment, factors affecting air microflora, significance of airborne microbes, and management of airborne microbes. b) <b>Techniques of trapping airborne microorganisms:</b> Gravity slide, petri plate exposure, liquid impingement, sieve device and filtration. c) <b>Air borne diseases</b> - Allergens, pathogens, significance of microorganisms in air. Control of air borne microorganisms</p>	<p style="text-align: center;">15 Hrs</p>	<p style="text-align: center;">KH</p>
<p><b>3. Microbiology of water</b> a) <b>Sources of water:</b> surface and ground water and their microbial contents. b) <b>Water pollution</b> - sources, water borne diseases-viral (Jaundice), bacterial (Cholera) and protozoan (amoebic dysentery), biological indicators of water pollution. c) <b>Determination of sanitary quality of water:</b> SPC tests for coliform. MPN. IMViC reactions, membrane filters technique. d) <b>Water purification in municipal water supply</b> – Potable water</p>	<p style="text-align: center;">18 Hrs</p>	<p style="text-align: center;">AS</p>
<p><b>4. Microbiology of waste water</b> a) <b>Introduction:</b> Source of waste water - domestic, agricultural and industrial, physical, chemical and microbiological characteristics of waste water. b) <b>Waste water treatment:</b> 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) and reclamation of waste water. c) <b>Waste as Resource (organic compost):</b> Solid waste in Biogas production and composting</p>	<p style="text-align: center;">25 Hrs</p>	<p style="text-align: center;">MP</p>
<p><b>5. Bioleaching</b> Scope, organisms involved, economic importance, mechanism of bioleaching of Cu and Fe.</p>	<p style="text-align: center;">04 Hrs</p>	<p style="text-align: center;">KH</p>

<p><b>6. Bio remediation</b></p> <p>Microbes in abatement of heavy metal pollution, heavy metal tolerance in Microbes, different microbial groups in bioremediation of environment.</p> <p><b>Biodegradation:</b> Petroleum (Hydrocarbons), pesticides (2,4-D and DDT)(in brief)</p>	05 Hrs	AS
<p style="text-align: center;"><b>PRACTICAL – Paper I</b></p> <ol style="list-style-type: none"> <li>1. Isolation of microorganisms from Soil, Air and Water</li> <li>2. Demonstration of air samplers - equipments of photographs of vertical cylinder spore trap. Rotorod samples,. Culture plate, Membrane filter</li> <li>3. Standard analysis of water samples</li> <li>4. Determination of quality of water by MPN test. H<sub>2</sub>S strip</li> <li>5. Water purification process (Baffles, Flocculator, Clarifier, Sand filter, back wash, chlorinometre and chloroscope) through photographs</li> <li>6. Estimation of solids in sewage.</li> <li>7. Isolation and enumeration of microorganisms from different water samples by serial dilution and pour plate.</li> <li>8. Demonstration of sewage treatment plants - Trickling filter, Imhoff tank, Septic tank and sewage treatment.</li> <li>9. Estimation of dissolved oxygen in water samples.</li> <li>10. Estimation of BOD, COD from Water sample</li> <li>11. Measurement of Ammonia, nitrate a nitrite up by Microorganisms.</li> </ol> <p><b>Note:</b> Visit to water treatment plant / sewage treatment plant. Report should be written and submitted along with practical record</p>		

<b>SEMESTER – V</b>		<b>60 Hrs</b>	Staff
<b>PAPER – II : SOIL AND AGRICULTURE MICROBIOLOGY</b>			
<b>Total hours allotted: 50</b>			
<b>1. Microbiology of soil</b> a. <b>Introduction:</b> Type, soil profile, physical and chemical characters. b. <b>Soil Microorganisms:</b> Bacteria, fungi, actinomycetes. algae, protozoa and viruses. c. <b>Role of Microbes in soil process:</b> Biogeochemical cycles - Carbon, Nitrogen, Sulphur and Phosphorous. Biodegradation: Pectin. Cellulose and lignin. d. <b>Rhizospheric Microorganisms:</b> Rhizosphere and rhizoplane, Interactions among microorganisms - Neutralism, Mutualism, Commensalism. Antagonism and Parasitism e. <b>Plant-microbe interaction:</b> Mycorrhizae		16 Hrs	KH
<b>2. Microorganisms in Agriculture</b> a) <b>Bio-fertilizers:</b> Types (Bacterial, fungal, phosphate solubilizers. BGA. Plants-Azolla). b) <b>Microbial bio-inoculants (PGPR's):</b> Phosphate solubilizing and cellulolytic. microorganisms, mass production of bacterial inoculants (Rhizobium and Cyanobacteria) mode of applications and merits.		16 Hrs	AS
c) <b>Bio-pesticides:</b> Types (Bacterial Bacillus thuringiensis, viral- NPV. Fungal (Trichoderma Metarhizium), mode of action, factors influencing and target pests.		06 Hrs	MP
<b>6. Microbial Disease of Agricultural crops.</b> A brief account of the causative agent. Symptoms and control of the following plant diseases: Fungal (Puccinia, Plasmodora, Cercospora, Pyricularia) Bacterial (Xanthomonas oryzae), Mycoplasma - Sandal spike. Grassyshoot. Viruses (TMV. Tomato leaf curl). Brief account of post harvest pathology.		12 Hrs	MP
<b>PRACTICAL: Paper II</b> 1. Isolation and enumeration of bacteria and fungi from rhizosphere and rhizoplane. 2. Study of Rhizobium from Legume root nodules (gram staining) and Isolation of Rhizobium(Using yeast extract Mannitol Agar) and Azotobacter (using Ashby's Mannitol Agar) from soil 3. Isolation of actinomycetes from soil using glucose Aspergin Agar by pour plate method. 4. Study of antagonism between soil microorganisms by plate method. 5. Study of plant pathogens - Tikka disease. Sandal spike, Downy Mildew and Tomato leaf curl. 6. Demonstration of caking of grains.			