MAHATMA GANDHI UNIVERSITY

Kottayam, Kerala

Undergraduate Programmes (HONOURS)
2024 Admission Onwards

SYLLABUS						
SIGNATURE COURSE						
Name of the College	Marthoma College, Kuttapuzha P.O, Tiruvalla					
Faculty/ Discipline	Botany					
Programme	BSc (Hons) Botany					
Course Coordinator	Susan Kuriakose					
Contributors	Reethu Mariah Jacob, Anitha Jose					
Course Name	Principles of Microbiology					
Type of Course	DSE					
Specialization title	Agricultural Microbiology					
Course Code	MG3DSEBOTA06					
Course Level	200					
Course Summary	This course introduces the fundamentals of microbiology with a focus on agricultural applications. Students will explore microbial diversity, cell structures, growth requirements, metabolic pathways, genetic recombination, and the roles of microorganisms in agriculture, industry, the environment, and food. Practical aspects include microbial staining, culture media preparation, isolation techniques, and enumeration methods.					
Semester	3	**Credits**			4	**Total Hours**
Course Details	**Learning Approach**	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
Pre-requisites, if any	Basic knowledge in Plant Science and laboratory skills					

Course Outcomes (CO)

Number of COs		**4**	
CO No.	**Expected Course Outcome**	**Learning Domains ***	**PO No**
1	Define and recall key characteristics of major microbial groups and their cellular structures.	K	PO1, PO2, PO3, PO4, PO6, PO10
2	Explain microbial growth requirements, metabolic pathways, and genetic mechanisms.	U	PO1, PO2, PO3, PO4, PO6, PO10
3	Demonstrate basic microbiological techniques	A	PO1, PO2, PO3, PO4, PO6, PO10
4	Differentiate between various microbial applications in agriculture, industry, environment, and food sectors.	E	PO1, PO2, PO3, PO4, PO6, PO7, PO8, PO10

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

CO-PO Articulation Matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	2	3	2	2	-	1	-	-	-	2
CO 2	2	3	2	1	-	1	-	-	-	2
CO 3	2	3	2	2	-	2	-	-	-	2
CO 4	3	3	3	2	-	2	2	2	-	2

'0' is No Correlation, '1' is Slight Correlation (Low level), '2' is Moderate Correlation (Medium level) and '3' is Substantial Correlation (High level).

Course Content

Content for Classroom transaction (Units)

Module	Units	Course Description	Hrs	CO No.
1	Introduction to Microbiology and Microbial Taxonomy			
	1.1	Microbial cell types: Prokaryotes vs. eukaryotes. (Brief account) Taxonomic hierarchy: Domain, kingdom, phylum. (Concept) Key groups of microorganisms: Bacteria, archaea, fungi, viruses, protozoa, algae (brief account)	5	["1"]
	1.2	Classification of bacteria- morphological & biochemical Cell structures: Cell wall (including Gram-positive & Gram-negative); membrane; organelles (brief account)	5	["1"]
	1.3	Growth requirements: Physical and Nutritional requirements of bacteria- Nutritional types	5	["2"]
2	Microbial Physiology and Genetics			
	2.1	Metabolism: Brief account of catabolism and anabolism- Glycolysis, Krebs' Cycle, ED pathway in bacteria; Fermentation; Photosynthesis	5	["2"]
	2.2	Genetic recombination in bacteria: Transformation, transduction, conjugation. (Brief account)	5	["2"]
	2.3	Reproduction in microorganisms; Viral replication (Lytic & Lysogenic cycle) Plasmids and its application in genetic engineering - (Golden rice & Bt Cotton)	5	["2"]
3	Applications of Microbiology			
	3.1	Microbial production of enzymes, organic acids and vitamins; Probiotics & SCPs (Brief account) Role of microorganisms in agriculture (biofertilizers, biopesticides, biocompost)	5	["4"]
	3.2	Environmental microbiology: Waste water treatment and Bioremediation	5	["4"]
	3.3	Food Microbiology -Microbial spoilage and foodborne illnesses. Fermentation in food production (beer, yogurt, appam, idli).	5	["4"]
4	Microbial culturing			
	4.1	Smear; Heat fixation; Stains and staining techniques; Gram's Staining (Activity: -Perform staining of microbes- Fungi, Bacteria (Gram's Staining) Microbial growth curve; Enumeration of microorganisms	5	["3"]
	4.2	Culture Media- Solid, liquid, semi-solid media; Selective & differential media; Isolation techniques- serial dilution, pour plate, spread plate, and streak plate (Activity: -Enumeration of the microbial population from soil – Bacteria, fungi, and Actinomycetes)	5	["3"]
	4.3	Media components & preparation- Nutrient Agar Medium & PDA medium. (Activity: -isolate and identify microorganisms using any one technique mentioned above)	5	["3"]

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lectures, Group discussion, Activity-based learning, case studies, and Survey report.

Assessment Types	**MODE OF ASSESSMENT** Mode of Assessment: Theory **A. Continuous Comprehensive Assessment (CCA)** **• Theory – 30 Marks** Assignments Field trip report and presentation Open book exams and Viva ,Any other method as may be required for specific course / student by the course faculty **B. End Semester Evaluation (ESE)** **• Theory – 70 Marks** Assessment Methods – Semester end examination Duration of Examination – 2.00 Hrs Pattern of examination for Theory – Non-MCQ Different parts of written examination – Part - A , B , C Answer Type: ∘ PART - A ∘ One or two Sentences - (10 out of 12) – 10 × 2 = 20 ∘ PART - B ∘ Short answer - (8 out of 10) – 8 × 5 = 40 ∘ PART - C ∘ Essays - (1 out of 2) – 1 × 10 = 10

References

- Coyne, M. S. (2004). Soil microbiology: An exploratory approach. Singapore: Thomson Asia Pte Ltd., Delmar Publishers
- Gardner, J. E., Simmons, M. J., & Snustad, D. P. (1991). Introduction to microbiology. New Delhi: Wiley Eastern.
- Paul, E. A. (2007). Soil microbiology, ecology, and biochemistry (3rd ed.). Burlington, MA: Academic Press.
- Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (2002). Microbiology. 5th Edition, Tata McGraw-Hill, New Delhi.
- Rangaswami, G., & Bagyaraj, D. J. (2009). Agricultural microbiology (2nd ed.). PHI Learning Private Limited. New Delhi.
- Brock, T. D. (1961). Milestones in microbiology. Infinity Books, Englewood Cliffs, N. J: Prentice-Hall.
- Stanier, R. Y., Ingraham, J. L., Wheelis, M. L., & Painter, P. R. (2003). Microbiology: Concepts and applications. New Delhi: Tata McGraw-Hill.
- Tauro, P., Kapoor, K. K., & Yadav, K. S. (1996). General microbiology. New Delhi: Macmillan India.
- Willey, J. M., Sherwood, L. M., & Woolverton, C. J. (2017). Prescott's Microbiology: International edition (10th ed.), McGraw-Hill Education.

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2024 Admission Onwards

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Faculty/ Discipline	Botany					
Programme	BSc (Hons) Botany					
Course Coordinator	Susan Kuriakose					
Contributors	Susan Kuriakose					
Course Name	Environmental and Industrial Microbiology in Agriculture					
Type of Course	DSE					
Specialization title	Agricultural Microbiology					
Course Code	MG4DSEBOTA06					
Course Level	200					
Course Summary	This course explores microorganisms' critical roles in agricultural production and sustainability. Students will investigate microbial effects on agroecosystems, such as nutrient cycling, pollutant degradation, and soil health. The program covers microbial waste management applications such as composting and bioremediation, and industrial microbiology techniques used to produce biofertilizers and biopesticides. The training emphasizes Kerala's traditional agricultural methods and combines indigenous microbiological techniques with current scientific methodologies to create resilient and environmentally friendly agriculture.					
Semester	4	**Credits**			4	**Total Hours**
Course Details	**Learning Approach**	Lecture	Tutorial	Practical	Others	
		4				60
Pre-requisites, if any	Basic knowledge in Plant Science and Microbiology					

Course Outcomes (CO)

Number of COs		**6**	
CO No.	**Expected Course Outcome**	**Learning Domains ***	**PO No**
1	Explain the scope and significance of environmental microbiology in agriculture.	U	PO1, PO2, PO3, PO4, PO6, PO7, PO10
2	Analyze the impact of agricultural pollution and evaluate microbial mitigation techniques.	E	PO1, PO2, PO3, PO5, PO6, PO7, PO8
3	Apply principles of fermentation technology to the production of agricultural inputs.	A	PO1, PO2, PO3, PO6, PO7, PO9
4	Design strategies for converting agricultural waste into value-added products.	C	PO1, PO2, PO3, PO6, PO7, PO9

Number of COs		6	
CO No.	**Expected Course Outcome**	**Learning Domains ***	**PO No**
5	Examine traditional farming practices in Kerala and evaluate their contributions to sustainable agriculture.	AN	PO2, PO3, PO6, PO7, PO8
6	Identify and describe traditional microbial practices in agriculture.	K	PO1, PO2, PO3, PO4, PO6, PO7, PO8, PO10

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

CO-PO Articulation Matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	3	2	1	-	2	2	-	-	2
CO 2	3	3	2	-	1	3	2	1	-	-
CO 3	2	3	3	-	-	2	2	-	3	-
CO 4	2	2	2	-	-	3	3	-	3	-
CO 5	-	2	2	-	-	3	3	2	-	-
CO 6	1	2	2	2	-	3	3	2	-	2

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Course Content

Content for Classroom transaction (Units)

Module	Units	Course Description	Hrs	CO No.
1	Environmental Microbiology in Agroecosystems			
	1.1	Introduction to Environmental Microbiology: Scope and importance in agriculture, Agroecosystems and microbial communities, Microbial indicators of soil and water quality.	5	["1"]
	1.2	Agricultural Pollution and Microbial Mitigation: Pesticide and heavy metal degradation by microbes, Biodegradation and biotransformation processes, Role of microbes in reducing agrochemical residues (Brief study).	5	["2"]
	1.3	Biogeochemical Cycles: Microbial roles in nitrogen, phosphorus, carbon, and sulphur cycles, Impact of agriculture on nutrient cycling (Brief study).	5	["2"]
2	Microbial Applications in Waste Management and Bioremediation			
	2.1	Agricultural Waste Management: Waste management using microbes. Bio composting, Conversion of agricultural waste to value-added products: Bioenergy and biofuels from agricultural waste.	5	["2"]
	2.2	Biochar, biogas, bio-oil, and organic acids from agro-wastes. Agro-industrial fermentation.	5	["4"]
	2.3	Bioremediation in agroecosystems. In situ and ex-situ bioremediation. Phytoremediation with microbial assistance.	5	["2"]

Module	Units	Course Description	Hrs	CO No.
3	Industrial Microbiology for Agricultural Inputs			
	3.1	Fermentation Technology in Agriculture: Principles and types of fermentation. Submerged vs. solid-state fermentation for agri-products.	5	["3"]
	3.2	Industrial fermentations: Aerobic and anaerobic fermentation, Alcoholic and Lactic acid fermentations (Activity: “Microbial Ecology and Physicochemical Dynamics in Bread/ Idli/Dosa/Wine/Beer Fermentations”)	5	["3"]
	3.3	Microbial Production of Agri-Inputs: Biofertilizers (Rhizobium, Azotobacter, PSB, etc). Biopesticides (Trichoderma, Bacillus thuringiensis, etc.). Plant growth-promoting substances (Gibberellins, IAA)	5	["3"]
4	Indigenous and Traditional Microbial Practices in Agriculture			
	4.1	Role of indigenous knowledge in microbial management. Traditional biofertilizers and their microbial components. (Activity: Isolation & Identification of Microorganisms from Panchagavya/Jeevamrutha/Beejamrutha using any suitable Technique” or (Prepare a chart illustrating the microbiology of Panchagavya, Jeevamrutha, and Beejamrutha.)	5	["6"]
	4.2	Biocontrol Agents in Traditional Pest and Disease Management: Indigenous biocontrol practices using microbial antagonists. (Activity: Conduct a survey on “Traditional botanical and microbial formulations for pest control”. or “Fermented plant extracts and their antimicrobial activity”)	5	["6"]
	4.3	Traditional Farming Practices in Kerala: Homestead Farming, Integrated Farming Systems, Pokkali Rice Cultivation, Kaipad Rice System, Attappady Thuvara, Vayal Classification, and Preservation of Indigenous Knowledge. (Activity: Case study - Below Sea Level Farming in Kuttanad/ Role of Women in Traditional Farming. or Field visit to familiarize with Pokkali Rice Cultivation/ Kaipad Rice System/ any other local rice cultivation practice)	5	["5"]

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Field Survey and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, Discussion-based Learning, Inquiry-Based Learning, Blended Learning, and other innovative learning approaches.

Assessment Types	**MODE OF ASSESSMENT** Mode of Assessment: Theory **A. Continuous Comprehensive Assessment (CCA)** **• Theory – 30 Marks** Assignments Field trip/case study report and presentation Open book exams and Viva or any other appropriate method **B. End Semester Evaluation (ESE)** **• Theory – 70 Marks** Assessment Methods – Semester end examination Duration of Examination – 2.00 Hrs Pattern of examination for Theory – Non-MCQ Different parts of written examination – Part - A , B , C Answer Type: ◦ PART - A ◦ One or two Sentences - (10 out of 12) – 10 × 2 = 20 ◦ PART - B ◦ Short answer - (8 out of 10) – 8 × 5 = 40 ◦ PART - C ◦ Essays - (1 out of 2) – 1 × 10 = 10

References

- 1. Acharya, C. L., Chaudhary, R. S., Gurumurthy, P., & Subba Rao, A. (Eds.). (2025). Blending Indian farmers' traditional knowledge in agriculture with modern scientific technologies: A way forward (813 pp.). Switzerland: Springer Nature Switzerland AG.
- 2. Adams, M. R., & Moss, M. O. (2008). Food microbiology (3rd ed.). Royal Society of Chemistry.
- 3. Mitchell, R. (1974). Introduction to environmental microbiology. Englewood Cliffs, NJ: Prentice-Hall.
- 4. Prasad, R. M., Govindan, M., & Sreekumar, K. M. (2013, June). Indigenous practices in farming systems of Kerala (Technical Report No. 3). Kerala Agricultural University.
- 5. Rao, N. S. S. (1995). Soil microorganisms and plant growth (3rd ed.). New Hampshire, USA: Science Publishers, Inc.

Suggested Readings

- Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (2002) Microbiology. 5th Edition, Tata McGraw-Hill, New Delhi.
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SYLLABUS						
SIGNATURE COURSE						
Name of the College	Marthoma College, Kuttapuzha P.O, Tiruvalla					
Faculty/ Discipline	Botany					
Programme	BSc (Hons) Botany					
Course Coordinator	Susan Kuriakose					
Contributors	Reethu Mariah Jacob, Anitha Jose					
Course Name	Soil Microbiology					
Type of Course	DSE					
Specialization title	Agricultural Microbiology					
Course Code	MG5DSEBOTA06					
Course Level	300					
Course Summary	This course explores the vital roles of soil microorganisms in maintaining soil health and fertility. Students will examine the diversity of soil microbes—including bacteria, fungi, actinomycetes, and protozoa—and their interactions within the soil ecosystem. Key topics include microbial involvement in nutrient cycling (carbon, nitrogen, phosphorus, sulfur), organic matter decomposition, and the impact of agricultural practices on microbial communities. The course also covers practical applications such as biofertilizers, biopesticides, composting, and biogas production, highlighting the significance of microbes in sustainable agriculture and environmental management.						
Semester	5	**Credits**			4	**Total Hours**
Course Details	**Learning Approach**	Lecture	Tutorial	Practical	Others	
		4				60
Pre-requisites, if any	Students should have at least introductory knowledge of Plant Science, microbiology, chemistry, and soil science.					

Course Outcomes (CO)

Number of COs		**5**	
CO No.	**Expected Course Outcome**	**Learning Domains ***	**PO No**
1	Recall and define key soil microbial groups and their ecological roles in nutrient cycling and organic matter decomposition.	K	PO1, PO2, PO3, PO4, PO6, PO10
2	Explain the physical and chemical characteristics of soil and their influence on microbial diversity and activity.	U	PO1, PO2, PO3, PO4, PO10
3	Understand soil genesis and soil profile.	U	PO1, PO2, PO3, PO4, PO10
4	Compare and contrast microbial interactions and evaluate their impact on plant health and soil fertility.	AN	PO1, PO2, PO3, PO4, PO6, PO7, PO10

Number of COs		5	
CO No.	**Expected Course Outcome**	**Learning Domains ***	**PO No**
5	Assess the effectiveness of sustainable agricultural practices in enhancing soil microbial communities and overall soil health.	E	PO1, PO2, PO3, PO6, PO7, PO10

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

CO-PO Articulation Matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	3	2	3	-	1	-	-	-	2
CO 2	3	3	3	2	-	-	-	-	-	2
CO 3	3	2	3	2	-	-	-	-	-	1
CO 4	3	3	2	1	-	2	2	-	-	2
CO 5	2	2	3	-	-	3	3	-	-	2

'0' is No Correlation, '1' is Slight Correlation (Low level), '2' is Moderate Correlation (Medium level) and '3' is Substantial Correlation (High level).

Course Content

Content for Classroom transaction (Units)

Module	Units	Course Description	Hrs	CO No.
1	The Soil and Microbial Community			
	1.1	Importance and ecological significance of soil microbiology. Physical characterization of soils- composition, texture, aeration, temperature, and organic matter. Chemical characterization of soils- composition, colloids, humus, pH, and cation exchange, water (Activity: Determine the pH of a soil sample using any suitable method).	5	["1", "2"]
	1.2	Soil Enzymes; Soil genesis & Soil profile (brief study); Weathering- Physical, Chemical & Biological processes. Factors influencing Soil Microbial population; Rhizosphere & Phyllosphere microflora; Microbial activity in soil organic matter formation.	5	["2", "3"]
	1.3	Types of microorganisms found in soil-Bacteria, Actinomycetes, Fungi, Cyanobacteria, Algae, Viruses, Protozoa. (Activity:-Enumeration of the microbial population from soil – Bacteria, fungi, and Actinomycetes). Microbial Interactions- (brief study) Commensalism; Amensalism; Symbiosis- Lichens & Mycorrhiza, Synergism, Proto cooperation; Competition; Predation	5	["1", "4"]
2	Microorganisms and Biogeochemical Cycles			
	2.1	Carbon cycle- Organic matter decomposition; Carbon sequestration. Phosphorus cycle - Microbial transformations of phosphorus	5	["1"]
	2.2	Sulphur Cycle (brief study). Nitrogen Cycle- Proteolysis, Ammonification, Nitrification, Assimilation, Denitrification	5	["1"]
	2.3	Nitrogen fixation- Nif genes and nodule formation. Activity: Visit any soil testing lab to experience the various soil analysis studies.	5	["1"]

Module	Units	Course Description	Hrs	CO No.
3	Microorganisms& Environmental Quality			
	3.1	Microorganisms in soil, air, and water: Bio-indicators of pollution.	5	["1"]
	3.2	Biochemical composition and biodegradation of organic matter in soil; Biocomposting. (Activity: Prepare a biocompost/ potting mixture using any organic matter)	5	["5"]
	3.3	Sewage treatment, Anaerobic sludge decomposition, Degradation of pesticides in soil.	5	["5"]
4	Microorganisms in sustainable agriculture			
	4.1	Impact of tillage, crop rotation, and cover cropping on soil microbes. Organic farming and microbes	5	["5"]
	4.2	Agricultural Waste Management & Silage Production	5	["5"]
	4.3	Biofertilizers; Biopesticides (Examples) Biofuel and Biogas production	5	["5"]

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lectures, Group discussion, Field trip, Survey report, Project-Based Learning, Experiential Learning, Peer Teaching, Inquiry-based Learning.

Assessment Types	**MODE OF ASSESSMENT** Mode of Assessment: Theory **A. Continuous Comprehensive Assessment (CCA)** **• Theory – 30 Marks** Assignments , Field trip report and presentation, Term paper preparation and presentation **B. End Semester Evaluation (ESE)** **• Theory – 70 Marks** Assessment Methods – Semester end examination Duration of Examination – 2.00 Hrs Pattern of examination for Theory – Non-MCQ Different parts of written examination – Part - A , B , C Answer Type: ∘ PART - A ∘ One or two Sentences - (10 out of 12) – 10 × 2 = 20 ∘ PART - B ∘ Short answer - (8 out of 10) – 8 × 5 = 40 ∘ PART - C ∘ Essays - (1 out of 2) – 1 × 10 = 10

References

- Rangaswami, G., & Bagyaraj, D. J. (2009). Agricultural Microbiology (2nd ed.). PHI Learning Private Limited, New Delhi.
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- Stainer, R. Y., Ingraham, J. L., Wheelis, M. L., & Painter, P. R. (2003). Microbiology: Concepts and applications. Tata McGraw-Hill.
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Faculty/ Discipline	Botany					
Programme	BSc (Hons) Botany					
Course Coordinator	Susan Kuriakose					
Contributors	Susan Kuriakose, Reethu Mariah Jacob, Anitha Jose					
Course Name	Plant Pathology					
Type of Course	DSE					
Specialization title	Agricultural Microbiology					
Course Code	MG6DSEBOTA06					
Course Level	300					
Course Summary	This course provides a comprehensive overview of plant diseases, encompassing their causes, development, and management. Students will explore fundamental concepts such as the disease triangle and disease cycle, delve into host-pathogen interactions, and examine the roles of enzymes, toxins, and plant defense mechanisms. The curriculum also introduces the plant microbiome's composition and functions, highlighting its relevance in sustainable agriculture. Practical sessions offer hands-on experience with microbiological techniques and equipping students with essential skills for diagnosing and managing plant diseases.					
Semester	6	**Credits**			4	**Total Hours**
Course Details	**Learning Approach**	Lecture	Tutorial	Practical	Others	
		3		1		75
Pre-requisites, if any	Students should have at least introductory knowledge of Plant Science, microbiology, and Plant Pathology.					

Course Outcomes (CO)

Number of COs		**6**	
CO No.	**Expected Course Outcome**	**Learning Domains ***	**PO No**
1	Define and explain the fundamental concepts of plant pathology.	U	PO1, PO2, PO3, PO4, PO6, PO10
2	Evaluate the impact of plant pathogens on plant metabolism and discuss the functional composition of plant microbiomes.	E	PO1, PO2, PO3, PO4, PO6, PO10
3	Develop and propose innovative strategies for sustainable plant disease management.	C	PO1, PO2, PO3, PO4, PO6, PO10
4	Identify major crop diseases, their symptoms, causal agents, and the stages of disease development.	K	PO1, PO2, PO3, PO4, PO6, PO10

Number of COs		6	
CO No.	**Expected Course Outcome**	**Learning Domains ***	**PO No**
5	Apply microbiology techniques and lab equipment to isolate and characterize plant-associated microorganisms, analyze, evaluate, and document field observations.	A	PO1, PO2, PO3, PO4, PO6, PO10
6	Propose a field trip report or mini project that blends classroom theory with real-world insights.	C	PO1, PO2, PO3, PO6, PO9, PO10

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CO 3	3	3	2	2	-	3	-	-	-	2
CO 4	3	3	2	1	-	2	-	-	-	2
CO 5	2	3	3	1	-	3	-	-	-	2
CO 6	2	3	2	-	-	3	-	-	3	2

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Course Content

Content for Classroom transaction (Units)

Module	Units	Course Description	Hrs	CO No.
1	Introduction to Plant Pathology and Process of disease development (			
	1.1	Plant microbiome: Composition, Functionalities (Brief study only). Concepts and principles of Plant Pathology: disease pyramid, disease cycle. Causes, development, signs & symptoms, control, and classification of plant diseases. (General account only)	5	["1"]
	1.2	Concept of Host-parasite interaction- Process of infection, disease development- the role of enzymes, toxins, growth regulators.	5	["2"]
	1.3	Defense strategies: oxidative burst, Phenolics, Phytoalexins, PR proteins, and Elicitors. Altered plant metabolism by plant pathogens. (Brief study only)	5	["2"]

Module	Units	Course Description	Hrs	CO No.
2	Major Crop Plant Diseases			
	2.1	Plant Diseases Caused by Environmental Factors. Diseases Caused by Viruses (Tapioca Mosaic Virus) and Viroids. Diseases Caused by Angiosperm Parasites, Algae, and Nematodes (Brief study only)	5	["4"]
	2.2	Diseases Caused by Plant-Pathogenic Fungi (Brief study on Causative organisms, Symptoms, and control measures only) Rice-Blast disease Ginger - Rhizome rot Pepper - Quick wilt Coconut – Grey leaf spot, Bud rot disease Rubber – Abnormal leaf fall, Powdery mildew Sugarcane – Red rot Arecanut – Mahali disease Tea - Blister blight Red rust Coffee - Leaf rust	5	["4"]
	2.3	Diseases Caused by Bacteria and Algae Rice-Bacterial blight Banana - Bacterial leaf blight Tea - Red rust (Brief study on Causative organisms, Symptoms, and control measures only) (Activity: Collect specimens of any 5 of the above-mentioned plant diseases)	5	["4"]
3	Disease Resistance and Management in Plants			
	3.1	Genetics of resistance; R genes; mechanism of genetic variation in pathogens; molecular basis for resistance; marker-assisted selection; genetic engineering for disease resistance. (Brief study only)	5	["3"]
	3.2	Methods of Control of Plant Diseases: Physical, Chemical, and Biological Methods. Integrated Pest Management. (Activity: Visit any local agricultural farm to observe and learn about the farming practices, associated plant diseases, their epidemiology, and the management practices)	5	["3"]
	3.3	New tools in Epidemiology: Forecasting of Plant Disease Epidemics, Disease Warning, and Expert Systems.	5	["3"]
4	Practical			
	4.1	General techniques and equipment used in a microbiology laboratory.	7	["5"]
	4.2	Isolation and Characterization of any one microorganism from the Plant microbiome.	9	["5"]
	4.3	Submit a Field Trip report (Visit to Commercial Mushroom production Unit/Biofertilizer lab/Pollution Control Board lab/ any other research institutions).	7	["6"]
	4.4	Submit specimens of any 5 of the plant diseases mentioned in the syllabus.	7	["4"]

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Field-based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, Discussion-based Learning, Inquiry-Based Learning, Blended Learning, and other innovative learning approaches.

Assessment Types	**MODE OF ASSESSMENT** Mode of Assessment: Both **A. Continuous Comprehensive Assessment (CCA)** **• Theory – 25 Marks** Home assignment, Field study report, Viva, Open Book Exam, Written test **• Practical – 15 Marks** Lab Involvement, Practical Skills, Record, Report **B. End Semester Evaluation (ESE)** **• Theory – 50 Marks** Assessment Methods – Semester end examination Duration of Examination – 1.50 Hrs Pattern of examination for Theory – Non-MCQ Different parts of written examination – Part - A , B , C Answer Type: ∘ PART - A ∘ One Sentence - (10 out of 12) – 10 × 1 = 10 ∘ PART - B ∘ Short Essays - (6 out of 8) – 6 × 5 = 30 ∘ PART - C ∘ Essays - (1 out of 2) – 1 × 10 = 10 **• Practical – 35 Marks** Assessment Methods – Practical Based Assessment: 20 , Field Trip Report:5 , Specimen Submission:5, Practical Record:5 Duration of Examination – 2.00 Hrs

References

- Agrios, G. N. (2005). Plant Pathology. Elsevier Academic Press.
- Borkar, S. G. (2017). History of Plant Pathology. CRC Press.
- Bush, J. (2019). Genetics of Plant Diseases. Scientific e-Resources.
- Cappuccino, J.G. and Sherman, N. (2013). Microbiology: A Laboratory Manual. 10th Edition, Pearson Education Limited, London.
- Gardner, J. E., Simmons, M. J., & Snustad, D. P. (1991). Introduction to Microbiology. Wiley Eastern.
- Mehrotra R., Aggarwal A., . (2016). Plant pathology. New Delhi: McGraw-Hill Education India Pvt Ltd., Chicago.
- Pandey, B. P. (2001). Plant pathology (Pathogen and Plant disease). S. Chand Publishing.
- Shrivastava, A., Tripathi, S. K., Bhele, M. S., & Yadav, V. K. (2022). Fundamentals of Plant Pathology. Scientific Publishers (India).
- Sharma, P. D. (2013). Plant pathology. Deep and Deep Publications.

Suggested Readings

- Stainer, R. Y., Ingraham, J. L., Wheelis, M. L., & Painter, P. R. (2003). Microbiology: Concepts and Applications. Tata McGraw-Hill.
- Dube, H. C. (2013). An introduction to fungi. Scientific Publishers.

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