

	MAHATMA GANDHI UNIVERSITY Kottayam, Kerala Undergraduate Programmes (HONOURS) 2025 Admission Onwards
---	---

SYLLABUS									
SIGNATURE COURSE									
Name of the College	Jawaharlal Nehru Institute of Arts & Science, Balagram P.O., Idukki								
Faculty/ Discipline	Microbiology								
Programme	BSc (Hons) Microbiology								
Course Coordinator	Dr Johnykutty J Ozhukayil								
Contributors	Sindhya Minnu R								
Course Name	Microbial Ecology of Agricultural Systems								
Type of Course	DSE								
Specialization title	Microbial Ecology of Agriculture Systems and the Microbiome and Human Health								
Course Code	MG3DSEMBGA00								
Course Level	200								
Course Summary	This course explores microbial ecology in agricultural systems and the role of the human microbiome in health and sustainability.								
Semester	3	Credits	4						
Course Details	<table><tr><td>Learning Approach</td><td>Lecture</td><td>Total Hours</td></tr><tr><td>Credits</td><td>4</td><td>60</td></tr></table>			Learning Approach	Lecture	Total Hours	Credits	4	60
	Learning Approach	Lecture	Total Hours						
Credits	4	60							
Pre-requisites, if any	Basic knowledge of microbiology and environmental science.								

Course Outcomes (CO)

Number of COs		4	
CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the principles of microbial ecology.	U	PO1, PO2, PO5, PO7
2	Analyse the role of Microbes and microbial products in Sustainable Agriculture	An	PO1, PO2, PO3, PO5, PO7, PO8, PO10
3	Analyse the significance of the agricultural microbiome in human health.	An	PO1, PO2, PO6, PO7, PO8, PO9, PO10
4	Hands-on training	U	PO1, PO2, PO3, PO4, PO5, PO7, PO8, PO9, 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	2	-	-	2	-	2	-	-	-
CO 2	3	2	1	-	3	-	3	1	-	1
CO 3	2	3	-	-	-	3	2	2	1	1
CO 4	2	3	3	3	2	-	1	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	Fundamentals of Microbial Ecology			
	1.1	Scope and significance of microbial ecology	3	["1"]
	1.2	Microbial habitats and ecological niches	3	["1"]
	1.3	Environmental factors influencing microbial populations.	4	["1"]
2	Microbes and microbial products in Sustainable Agriculture			
	2.1	Microbial diversity in agricultural ecosystems	5	["2"]
	2.2	Organic farming and microbial applications. Compost microbiology	5	["2"]
	2.3	Bioinoculants, Microbial enzymes in agriculture	5	["2"]
3	Introduction to agricultural microbiome in human health			
	3.1	Transfer of microbes from soil and plants to humans. Beneficial and harmful effects of agricultural microbes on human health.	5	["3"]
	3.2	Food contamination and food-borne pathogens.	5	["3"]
	3.3	Introduction to probiotics and gut microbiota	5	["3"]
4	HANDS-ON TRAINING Serial dilution technique for soil samples			
	4.1	HANDS-ON TRAINING Serial dilution technique for soil samples Observation of fungal spores from agricultural soil samples Isolation of phosphate-solubilizing microorganisms	20	["4"]

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Classroom Procedure (Mode of transaction) > Direct Instruction: Chalk and Board, PowerPoint presentations, Lectures, Explicit Teaching, E-learning > Interactive Instruction: Active cooperative learning, Assignments and discussions, Peer teaching and learning, Quiz, ICT-enabled learning Laboratory instructions, Demonstration of methods & Hands-on experiments
---------------------------------------	--

Assessment Types	MODE OF ASSESSMENT Mode of Assessment: Theory
	A. Continuous Comprehensive Assessment (CCA) • Theory - 30 Marks • Test/Quiz (10 marks) • Seminar (10 marks) • Assignment (5 marks), VIVA -5
	B. End Semester Evaluation (ESE) • Theory - 70 Marks Assessment Methods - Total Marks 70 Duration of Examination 2 hours Pattern of examination for Theory Different parts of written examination Part - A, B, C, D Duration of Examination - 2.00 Hrs Duration of Examination - 2.00 Hrs Pattern of examination for Theory - Non-MCQ Different parts of written examination - Part - A , B , C , D Answer Type: ◦ PART - A ◦ One or two Sentences - (10 out of 12) - $10 \times 1 = 10$ ◦ PART - B ◦ Short answer - (5 out of 7) - $5 \times 3 = 15$ ◦ PART - C ◦ Short Essays - (5 out of 7) - $5 \times 6 = 30$ ◦ PART - D ◦ Essays - (1 out of 1) - $1 \times 15 = 15$

References

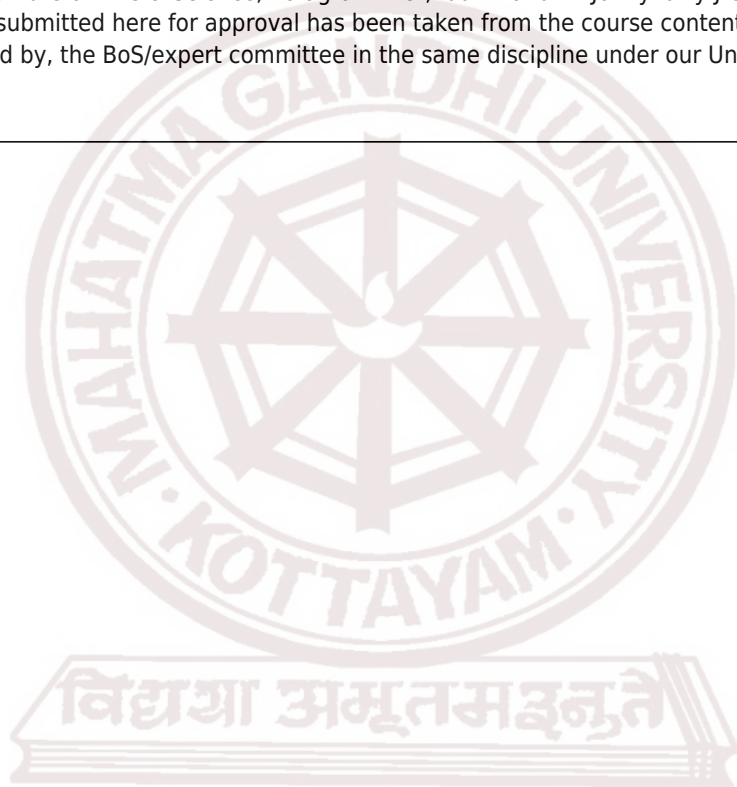
- 1. Atlas, R. M., & Bartha, R. (1998). Microbial ecology: Fundamentals and applications (4th ed.). Benjamin/Cummings Publishing Company.
- 2. Satyanarayana, T., Das, S. K., & Johri, B. N. (Eds.). (2019). Microbial diversity in ecosystem sustainability and biotechnological applications: Vol. 2. Soil and agroecosystems. Springer.
- 3. Yadav, A. N., Singh, J., Rastegari, A. A., & Yadav, N. (Eds.). (2020). Plant microbiomes for sustainable agriculture. Springer.
- 4. Chhabra, S., Prasad, R., Maddela, N. R., & Tuteja, N. (Eds.). (2023). Plant microbiome for plant productivity and sustainable agriculture. Springer.
- Practical Total Marks 15 Assessment Methods • Viva (5 marks) • Lab involvement (10 marks) Adjusted to 7.5 Marks for final calculation
- B. End Semester Evaluation (ESE) Theory Total Marks 50 Assessment Methods Duration of Examination 2 hours Pattern of examination for Theory Different parts of written examination {Part - A, B, C Answer Type: • Part A Short answer type question (Any 10 out of 12) - $10 \times 2 = 20$ • Part B Short essay question (Any 4 out of 6) - $4 \times 5 = 20$ • Part C Long essay question (Any 1 out of 2) - $1 \times 10 = 10$ Practical Total Marks 35 Assessment Methods • Experiments (25 marks) • Record (5 marks) • Viva voce (5 marks) Adjusted to 17.5 Marks for final calculation Duration of Examination : 2 hours
- 5. Singh, D. P., Gupta, V. K., & Prabha, R. (Eds.). (2019). Microbial interventions in agriculture and environment: Vol. 2. Rhizosphere, microbiome and agro-ecology. Springer.
- 6. Rekadwad, B. N. (Ed.). (2025). Microbial ecology: Microbiomes, viromes, and biofilms. CRC Press.

Suggested Readings

- 1. Srivastava, A. K., Kashyap, P. L., & John, M. S. (2021). The plant microbiome in sustainable agriculture. Wiley.
- 2. Bhatia, R. K., & Walia, A. (Eds.). (2024). Advancements in microbial biotechnology for soil health. Springer.
- 3. Kashyap, P. L., Kumar, S., & Srivastava, A. K. (Eds.). (2019). Unravelling the soil microbiome: Perspectives for environmental sustainability. Springer.
- 4. Parray, J. A., Abd-Allah, E. F., Shameem, N., & Mir, M. Y. (Eds.).

Affidavit

- We, Jawaharlal Nehru Institute of Arts & Science, Balagram P.O., Idukki and Dr Johnykutty J Ozhukayil, retain the copyright of this syllabus and expressly prohibit its distribution in complete form to any institution outside our own.
- We, Jawaharlal Nehru Institute of Arts & Science, Balagram P.O., Idukki, agree to appoint a new course coordinator for the proposed Microbial Ecology of Agriculture Systems and the Microbiome and Human Health in the event of the unavailability of the currently nominated coordinator. This appointment will ensure the continued coordination of course delivery, assessments, and all related academic responsibilities necessary for the successful implementation of the specialization, for as long as the college offers this programme.
- We, Jawaharlal Nehru Institute of Arts & Science, Balagram P.O., Idukki and Dr Johnykutty J Ozhukayil, declare that no part of this signature course submitted here for approval has been taken from the course content developed by, or from any of the course titles prepared by, the BoS/expert committee in the same discipline under our University.



MGU-UGP (HONOURS)

Syllabus

	MAHATMA GANDHI UNIVERSITY Kottayam, Kerala Undergraduate Programmes (HONOURS) 2025 Admission Onwards
---	---

SYLLABUS									
SIGNATURE COURSE									
Name of the College	Jawaharlal Nehru Institute of Arts & Science, Balagram P.O., Idukki								
Faculty/ Discipline	Microbiology								
Programme	BSc (Hons) Microbiology								
Course Coordinator	Dr Johnykutty J Ozhukayil								
Contributors	Sindhya Minnu R								
Course Name	MICROBIOME IN AGRICULTURE AND HUMAN HEALTH								
Type of Course	DSE								
Specialization title	Microbial Ecology of Agriculture Systems and the Microbiome and Human Health								
Course Code	MG4DSEMBGA00								
Course Level	200								
Course Summary	This course explores microbial ecology of agricultural systems and the role of the human microbiome in health and sustainability.								
Semester	4	Credits	4						
Course Details	<table><tr><td>Learning Approach</td><td>Lecture</td><td>Total Hours</td></tr><tr><td>Credits</td><td>4</td><td>60</td></tr></table>			Learning Approach	Lecture	Total Hours	Credits	4	60
	Learning Approach	Lecture	Total Hours						
Credits	4	60							
Pre-requisites, if any	BASIC KNOWLEDGE IN MICROBIOLOGY								

Course Outcomes (CO)

Number of COs		4	
CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the overview of human microbiome	K, U	PO1, PO2, PO10
2	Analyze the concepts of microbial ecology, livestock, environment and one health.	An	PO1, PO2, PO3, PO6, PO7, PO10
3	Applications of microbiome in sustainable agriculture	U	PO1, PO2, PO3, PO6, PO7, PO8, PO10
4	Hands on training	U	PO2, PO3, PO4, PO5, PO6, PO9, 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	1	-	-	-	-	-	-	-	1
CO 2	3	3	1	-	-	2	1	-	-	1
CO 3	1	3	2	-	-	3	2	1	-	1
CO 4	-	3	1	1	2	1	-	-	1	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 the Human Microbiome		
	1.1	Definition of microbiome and microbiota □ History of microbiome research	5	["1"]
	1.2	Overview of human-associated microbial habitats i. Gut microbiome ii. Skin microbiome iii. Oral microbiome iv. Vaginal microbiome v. Respiratory microbiome	10	["1"]
2		Microbial ecology concepts		
	2.1	□ Ecological niches □ Biofilms	5	["2"]
	2.2	Livestock, Environment, and One Health	10	["2"]
3		Microbiome Applications in Sustainable Agriculture		
	3.1	Biofertilizers & Biopesticides: Commercial production and application of Rhizobium, Azotobacter, Azospirillum, and Bacillus thuringiensis (Bt).	10	["3"]
	3.2	□ Composting & Soil Structure: The microbiome of vermicomposting and organic waste degradation. □ Biocontrol: Mechanisms of suppressing soil-borne plant pathogens using beneficial microbes.	10	["3"]
4		Practicals		
	4.1	Aseptic handling of microbiological samples □ Sterilization methods □ Preparation of culture media □ Sample Collection and Processing □ Oral swab collection Skin swab sampling	10	["4"]

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Classroom Procedure (Mode of transaction) □ Direct Instruction: Chalk and Board, PowerPoint presentations, Lectures, Explicit Teaching, E-learning □ Interactive Instruction: Active cooperative learning, Assignments and discussions, Peer teaching and learning, Quiz, ICT-enabled learning Laboratory instructions, Demonstration of methods & Hands-on experiments
---------------------------------------	--

Assessment Types	MODE OF ASSESSMENT Mode of Assessment: Theory
	A. Continuous Comprehensive Assessment (CCA) • Theory - 30 Marks □ Test/Quiz (10 marks) □ Seminar (10 marks) □ Assignment (5 marks), viva - 5 marks
	B. End Semester Evaluation (ESE) • Theory - 70 Marks Assessment Methods - Duration of Examination 2 hours Pattern of examination for Theory Different parts of written examination {Part - A, B, C Duration of Examination - 2.00 Hrs Pattern of examination for Theory - Non-MCQ Different parts of written examination - Part - A, B, C, D Answer Type: ◦ PART - A ◦ One or two Sentences - (10 out of 12) - $10 \times 1 = 10$ ◦ PART - B ◦ Short answer - (5 out of 7) - $5 \times 3 = 15$ ◦ PART - C ◦ Short Essays - (5 out of 7) - $5 \times 6 = 30$ ◦ PART - D ◦ Essays - (1 out of 1) - $1 \times 15 = 15$

References

- 1. Cho, I., & Blaser, M. J. (2012). The human microbiome: At the interface of health and disease. *Nature Reviews Genetics*, 13(4), 260-270.
- 2. Gill, S. R., Pop, M., Deboy, R. T., Eckburg, P. B., Turnbaugh, P. J., Samuel, B. S., Gordon, J. I., Relman, D. A., Fraser-Liggett, C. M., & Nelson, K. E. (2006). Metagenomic analysis of the human distal gut microbiome. *Science*, 312(5778), 1355-1359.
- 3. Grice, E. A., & Segre, J. A. (2012). The human microbiome: Our second genome. *Annual Review of Genomics and Human Genetics*, 13, 151-170.
- 4. Huttenhower, C., Gevers, D., Knight, R., Abubucker, S., Badger, J. H., Chinwalla, A. T., Creasy, H. H., Earl, A. M., Fitzgerald, M. G., Fulton, R. S., Giglio, M. G., Hallsworth-Pepin, K., Lobos, E. A., Madupu, R., Magrini, V., Martin, J. C., Mitreva, M., Muzny, D. M., Sodergren, E. J., ... White, O. (2012). Structure, function and diversity of the healthy human microbiome. *Nature*, 486(7402), 207-214.
- 5. Kinross, J. M., von Roon, A. C., Holmes, E., Darzi, A., & Nicholson, J. K. (2008). The human gut microbiome: Implications for future health care. *Current Gastroenterology Reports*, 10(4), 396-403.
- 6. Methé, B. A., Nelson, K. E., Pop, M., Creasy, H. H., Giglio, M. G., Huttenhower, C., Gevers, D., Petrosino, J. F., Abubucker, S., Badger, J. H., Chinwalla, A. T., Earl, A. M., Fitzgerald, M. G., Fulton, R. S., Hallsworth-Pepin, K., Lobos, E. A., Madupu, R., Magrini, V., Martin, J. C., ... White, O. (2012). A framework for human microbiome research. *Nature*, 486(7402), 215-221.

Suggested Readings

- Petersen, C., & Round, J. L. (2014). Defining dysbiosis and its influence on host immunity and disease. *Cellular Microbiology*, 16(7), 1024-1033.

Affidavit

- We, Jawaharlal Nehru Institute of Arts & Science, Balagram P.O., Idukki and Dr Johnykutty J Ozhukayil, retain the copyright of this syllabus and expressly prohibit its distribution in complete form to any institution outside our own.
- We, Jawaharlal Nehru Institute of Arts & Science, Balagram P.O., Idukki, agree to appoint a new course coordinator for the proposed Microbial Ecology of Agriculture Systems and the Microbiome and Human Health in the event of the unavailability of the currently nominated coordinator. This appointment will ensure the continued coordination of course delivery, assessments, and all related academic responsibilities necessary for the successful implementation of the specialization, for as long as the college offers this programme.
- We, Jawaharlal Nehru Institute of Arts & Science, Balagram P.O., Idukki and Dr Johnykutty J Ozhukayil, declare that no part of this signature course submitted here for approval has been taken from the course content developed by, or from any of the course titles prepared by, the BoS/expert committee in the same discipline under our University.



MGU-UGP (HONOURS)

Syllabus

	MAHATMA GANDHI UNIVERSITY Kottayam, Kerala Undergraduate Programmes (HONOURS) 2025 Admission Onwards
---	---

SYLLABUS									
SIGNATURE COURSE									
Name of the College	Jawaharlal Nehru Institute of Arts & Science, Balagram P.O., Idukki								
Faculty/ Discipline	Microbiology								
Programme	BSc (Hons) Microbiology								
Course Coordinator	Dr Johnykutty J Ozhukayil								
Contributors	Sindhya Minnu R								
Course Name	Microbiome Interactions in Food, Agriculture, and Human Health								
Type of Course	DSE								
Specialization title	Microbial Ecology of Agriculture Systems and the Microbiome and Human Health								
Course Code	MG5DSEMBGA00								
Course Level	300								
Course Summary	This course provides an interdisciplinary understanding of human microbial communities and their connections with agriculture and human health.								
Semester	5	Credits	4						
Course Details	<table><tr><td>Learning Approach</td><td>Lecture</td><td>Total Hours</td></tr><tr><td>Credits</td><td>4</td><td>60</td></tr></table>			Learning Approach	Lecture	Total Hours	Credits	4	60
	Learning Approach	Lecture	Total Hours						
Credits	4	60							
Pre-requisites, if any									

Course Outcomes (CO)

Number of COs		4	
CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the concepts of microbial communities	U	PO1, PO2, PO4, PO6, PO10
2	Analyze the interaction of microbiome with agriculture, food and human health	An	PO1, PO2, PO3, PO4, PO6, PO7, PO8, PO9, PO10
3	Analyze the role of microbial ecology in human health	An	PO1, PO2, PO3, PO4, PO6, PO7, PO8, PO9, PO10
4	Hands on training	U	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, 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	1	-	1	-	1	-	-	-	1
CO 2	3	1	2	2	-	3	3	1	1	2
CO 3	3	1	3	2	-	3	2	1	1	2
CO 4	1	3	1	2	2	1	1	3	1	1

'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		Human Microbial Communities		
	1.1	Composition and function of the healthy human microbiome (skin, gut, oral, respiratory tract).	10	["1"]
	1.2	Intersection: Agriculture, Food, and Human Health Diet and Microbiome: Influence of agricultural products, fiber, and phytochemicals on the human gut microbiome.	5	["2"]
2		Fermented Foods:		
	2.1	Microbial ecology of yogurt, cheese, fermented vegetables, and their role as probiotics.	10	["2"]
	2.2	Food Safety and Spoilage: Microbial communities in food production and spoilage.	5	["2"]
3		Antibiotic Resistance in Food Chains:		
	3.1	Transmission of resistance genes from agricultural soils and	5	["3"]
	3.2	One Health Approach: Integrating soil, plant, animal, and human health to ensure food security and sustainability.	5	["3"]
4		HANDS ON TRAINING		
	4.1	1. Gram staining of bacterial isolates. 2. MBRT Test 3. Antibiotic Sensitivity Testing (AST) 4. Preparation of any fermented food	20	["4"]

Syllabus

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Direct Instruction: Chalk and Board, PowerPoint presentations, Lectures, Explicit Teaching, E-learning □ Interactive Instruction: Active cooperative learning, Assignments and discussions, Peer teaching and learning, Quiz, ICT-enabled learning Laboratory instructions, Demonstration of methods & Hands-on experiments
---------------------------------------	---

Assessment Types	MODE OF ASSESSMENT Mode of Assessment: Theory
	A. Continuous Comprehensive Assessment (CCA) • Theory - 30 Marks □ Test/Quiz (10 marks) □ Seminar (10 marks) □ Assignment/viva (10marks)
	B. End Semester Evaluation (ESE) • Theory - 70 Marks Assessment Methods - Duration of Examination 2 hours Pattern of examination for Theory Different parts of written examination { Part - A, B, C Duration of Examination - 2.00 Hrs Pattern of examination for Theory - Non-MCQ Different parts of written examination - Part - A , B , C , D Answer Type: • PART - A • One or two Sentences - (10 out of 12) - $10 \times 1 = 10$ • PART - B • Short answer - (5 out of 7) - $5 \times 3 = 15$ • PART - C • Short Essays - (5 out of 7) - $5 \times 6 = 30$ • PART - D • Essays - (1 out of 1) - $1 \times 15 = 15$

References

- Doyle, M. P., Diez-Gonzalez, F., & Hill, C. (Eds.). (2019). Food microbiology: Fundamentals and frontiers (5th ed.). ASM Press.
- Frazier, W. C., & Westhoff, D. C. (2017). Food microbiology (5th ed.). McGraw Hill Education (India). Agriculture & Microbial Ecology 3. Paul, E. A. (Ed.). (2015). Soil microbiology, ecology and biochemistry (4th ed.). Academic Press.
- Rangaswami, G., & Bagyaraj, D. J. (2005). Agricultural microbiology (2nd ed.). PHI Learning.
- Stacey, G., & Keen, N. T. (Eds.). (1996). Plant-microbe interactions (Vol. 1). Springer. Human Health & Microbial Ecology

Suggested Readings

- 1. Atlas, R. M., & Bartha, R. (1998). Microbial ecology: Fundamentals and applications (4th ed.). Benjamin Cummings.
- 2. Madigan, M. T., Bender, K. S., Buckley, D. H., Sattley, W. M., & Stahl, D. A. (2021). Brock biology of microorganisms (16th ed.). Pearson.
- 3. Marchesi, J. R. (Ed.). (2014). The human microbiota and microbiome. CABI.
- 4. Willey, J. M., Sherwood, L. M., & Woolverton, C. J. (2020). Prescott's microbiology (11th ed.). McGraw-Hill Education.

Affidavit

- We, Jawaharlal Nehru Institute of Arts & Science, Balagram P.O., Idukki and Dr Johnykutty J Ozhukayil, retain the copyright of this syllabus and expressly prohibit its distribution in complete form to any institution outside our own.
- We, Jawaharlal Nehru Institute of Arts & Science, Balagram P.O., Idukki, agree to appoint a new course coordinator for the proposed Microbial Ecology of Agriculture Systems and the Microbiome and Human Health in the event of the unavailability of the currently nominated coordinator. This appointment will ensure the continued coordination of course delivery, assessments, and all related academic responsibilities necessary for the successful implementation of the specialization, for as long as the college offers this programme.

- We, Jawaharlal Nehru Institute of Arts & Science, Balagram P.O., Idukki and Dr Johnykutty J Ozhukayil, declare that no part of this signature course submitted here for approval has been taken from the course content developed by, or from any of the course titles prepared by, the BoS/expert committee in the same discipline under our University.



MGU-UGP (HONOURS)

Syllabus

	MAHATMA GANDHI UNIVERSITY Kottayam, Kerala Undergraduate Programmes (HONOURS) 2025 Admission Onwards
---	---

SYLLABUS									
SIGNATURE COURSE									
Name of the College	Jawaharlal Nehru Institute of Arts & Science, Balagram P.O., Idukki								
Faculty/ Discipline	Microbiology								
Programme	BSc (Hons) Microbiology								
Course Coordinator	Dr Johnykutty J Ozhukayil								
Contributors	Sindhya Minnu R								
Course Name	Plant Health and Microbial Biotechnology								
Type of Course	DSE								
Specialization title	Microbial Ecology of Agriculture Systems and the Microbiome and Human Health								
Course Code	MG6DSEMBGA00								
Course Level	300								
Course Summary	This course explains major plant diseases caused by bacteria, fungi, and viruses and their impact on crops. It also covers the beneficial roles of microorganisms in agriculture through biofertilizers, biopesticides, and bio stimulants. In addition, it highlights how agricultural microbiomes influence human health, nutrition, and immunity, along with practical training in microbial isolation and field exposure.								
Semester	6	Credits	4						
Course Details	<table><tr><td>Learning Approach</td><td>Lecture</td><td>Total Hours</td></tr><tr><td>Credits</td><td>4</td><td>60</td></tr></table>			Learning Approach	Lecture	Total Hours	Credits	4	60
	Learning Approach	Lecture	Total Hours						
Credits	4	60							
Pre-requisites, if any	MGU-UGP (HONOURS)								

Course Outcomes (CO)

Number of COs		6	
CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Identify major plant diseases caused by fungi, bacteria and viruses.	U	PO1, PO2, PO3, PO7, PO10
2	Apply beneficial microorganisms for improving soil fertility and crop productivity.	U	PO1, PO2, PO3, PO6, PO7, PO10
3	Analyse the significance of the agricultural microbiome in human health and disease	An	PO1, PO2, PO3, PO6, PO7, PO10
4	Apply microbiology techniques and lab equipment to isolate and characterize plant-associated microorganisms, analyze, evaluate, and document field observations.	A	PO1, PO2, PO4, PO10

Number of COs		6	
CO No.	Expected Course Outcome	Learning Domains *	PO No
5	Identify major crop diseases, their symptoms, causal agents, and the stages	K	PO1, PO2, PO3, PO7, PO10
6	Prepare a structured field trip report or mini project incorporating classroom learning and practical exposure.	U	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, 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	2	1	-	-	-	2	-	-	2
CO 2	3	3	2	-	-	2	3	-	-	3
CO 3	3	2	3	-	-	2	2	-	-	2
CO 4	2	3	-	1	-	-	-	-	-	3
CO 5	3	2	1	-	-	-	1	-	-	2
CO 6	2	1	2	3	2	2	1	1	3	3

'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	Major Plant Diseases			
	1.1	Classification of plant diseases- bacteria, virus, fungi	4	["1"]
	1.2	Plant diseases caused by bacteria-Bacterial wilt, bacterial leaf spot, crown gall, bacterial soft rot, citrus canker (Causative organisms, symptoms, modes of transmission of plant diseases)	4	["1"]
	1.3	Plant diseases caused by fungi-powdery mildew, downy mildew, late blight, anthracnose (Causative organisms, symptoms, modes of transmission of plant diseases)	4	["1"]
	1.4	Plant diseases caused by virus-Tobacco mosaic virus, potato leafroll, cassava mosaic disease (Causative organisms, symptoms, modes of transmission of plant diseases)	4	["1"]
2	Microbial application in agriculture			
	2.1	Microbes as Biofertilizers- Rhizobium, Azotobacter, Bacillus megaterium	6	["2"]
	2.2	Microbes as biopesticide- Bacillus thuringiensis, Trichoderma, Pateuria penetrans	4	["2"]
	2.3	Microbes as biostimulants - Bacillus amyloliquefaciens, Pseudomonas putida, Bacillus licheniformis	4	["2"]

Module	Units	Course Description	Hrs	CO No.
3	Agricultural microbiome in human health			
	3.1	Definition of agricultural microbiome, Types of microorganisms in agriculture , Benefits to human health and importance in sustainable agriculture	4	["3"]
	3.2	Agricultural Practices Affecting the Microbiome- Chemical Fertilizers and Soil Microbiome, Pesticides and Herbicides Impact, Antibiotic Use in Livestock Farming, Monocropping and Intensive Farming, Sustainable Agricultural Practices	3	["3"]
	3.3	Impact of Microbiome Loss on Human Health- Reduced Nutritional Quality of Food, Gut Microbiome Imbalance (Dysbiosis), Weak Immune System, Foodborne Diseases and Infections, Chronic and Lifestyle Diseases	3	["3"]
4	Hands on training			
	4.1	Isolation and characterisation of anyone bacteria from plant microbiome.	5	["4"]
	4.2	Isolation of anyone fungi from plant microbiome	5	["4"]
	4.3	Submit five syllabus-compliant plant disease specimens	5	["5"]
	4.4	Submit field trip report (visit to biocontrol and bio-input formulation labs/Commercial plant tissue culture laboratories/Commercial mushroom production units/any other research institution	5	["6"]

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: Theory
	A. Continuous Comprehensive Assessment (CCA) • Theory - 30 Marks Assignment, - 5 Field study report-10, Viva-5, Open Book Exam-10
	B. End Semester Evaluation (ESE) • Theory - 70 Marks Assessment Methods - Total Marks 70 Duration of Examination 2 hours Pattern of examination for Theory Different parts of written examination Part - A, B, C, D Duration of Examination - 2.00 Hrs Duration of Examination - 2.00 Hrs Pattern of examination for Theory - Non-MCQ Different parts of written examination - Part - A , B , C , D Answer Type: • PART - A • One or two Sentences - (10 out of 12) - $10 \times 1 = 10$ • PART - B • Short answer - (5 out of 7) - $5 \times 3 = 15$ • PART - C • Short Essays - (5 out of 7) - $5 \times 6 = 30$ • PART - D • Essays - (1 out of 1) - $1 \times 15 = 15$

References

- 1. Agrios, G. N. (2005). Plant Pathology (5th Edition). Academic Press.
- 2. Mehrotra, R. S. & Agarwal, A. (2017). Plant Pathology (2nd Edition). McGraw Hill Education.
- 3. Subba Rao, N. S. (2014). Biofertilizers in Agriculture and Forestry. Oxford & IBH Publishing.
- 4. Atlas, R. M. (2010). Handbook of Microbiological Media. CRC Press.
- 5. Alexander, M. (1977). Introduction to Soil Microbiology. Wiley Eastern.
- 6. Lynch, J. M. & Hobbie, J. E. (1988). Microorganisms in Action. Blackwell Scientific.
- 7. Rao, M. S. (2016). Biopesticides in Sustainable Agriculture. Springer.
- 8. Kloepper, J. W. & Schroth, M. N. (1978). Plant growth-promoting rhizobacteria.

Suggested Readings

- Pepper, I. L., Gerba, C. P., & Gentry, T. J. (2015). Environmental microbiology (3rd ed.). Academic Press.
- Turnbaugh, P. J., Ley, R. E., Hamady, M., Fraser-Liggett, C. M., Knight, R., & Gordon, J. I. (2007). The human microbiome project. Nature, 449(7164), 804-810.

Affidavit

- We, Jawaharlal Nehru Institute of Arts & Science, Balagram P.O., Idukki and Dr Johnykutty J Ozhukayil, retain the copyright of this syllabus and expressly prohibit its distribution in complete form to any institution outside our own.
- We, Jawaharlal Nehru Institute of Arts & Science, Balagram P.O., Idukki, agree to appoint a new course coordinator for the proposed Microbial Ecology of Agriculture Systems and the Microbiome and Human Health in the event of the unavailability of the currently nominated coordinator. This appointment will ensure the continued coordination of course delivery, assessments, and all related academic responsibilities necessary for the successful implementation of the specialization, for as long as the college offers this programme.
- We, Jawaharlal Nehru Institute of Arts & Science, Balagram P.O., Idukki and Dr Johnykutty J Ozhukayil, declare that no part of this signature course submitted here for approval has been taken from the course content developed by, or from any of the course titles prepared by, the BoS/expert committee in the same discipline under our University.



MGU-UGP (HONOURS)

Syllabus