MAHATMA GANDHI UNIVERSITY

Kottayam, Kerala

Undergraduate Programmes (HONOURS)
2024 Admission Onwards

SYLLABUS						
SIGNATURE COURSE						
Name of the College	Sree Vidyadiraja NSS College, Vazhoor					
Faculty/ Discipline	Botany					
Programme	BSc (Hons) Botany					
Course Coordinator	Dr. Jayakumar K					
Contributors	Dr. Jayakumar K, Dr. Prita Pillai					
Course Name	Agrotourism					
Type of Course	DSE					
Specialization title	Agrobotany					
Course Code	MG3DSEBOTA01					
Course Level	200					
Course Summary	This syllabus covers fundamentals of agrotourism including agrotourism business planning, marketing, and the rural development. This also explores farm-to-table experiences, event hosting, digital marketing, and the smart farming. Through the field visits, case studies, and business model analysis, the students will gain practical insights to develop and manage successful agrotourism ventures.					
Semester	3	**Credits**			4	**Total Hours**
Course Details	**Learning Approach**	Lecture	Tutorial	Practical	Others	
		4				60
Pre-requisites, if any	Nil					

Course Outcomes (CO)

Number of COs		**5**	
CO No.	**Expected Course Outcome**	**Learning Domains ***	**PO No**
1	Understand the concept, objectives, scopes and the various components of agrotourism.	U	PO6, PO10
2	Understand how agrotourism promotes rural development, economic diversification, and the sustainability.	U	PO6, PO7, PO10
3	Analyze agrotourism business plannings, management strategies, and the marketing techniques.	AN	PO1, PO3
4	Create agrotourism-based business models by analyzing existing farm strategies and proposing improvements for the sustainable rural development and community participation.	C	PO2, PO9
5	Evaluate the successful agrotourism projects and evaluate their impact on rural communities.	E	PO1

**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
CO 2	-	-	-	-	-	3	3	-	-	3
CO 3	3	-	2	-	-	-	-	-	-	-
CO 4	-	3	-	-	-	-	-	-	3	-
CO 5	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	Introduction to Agrotourism (15 hours)			
	1.1	Introduction to Agrotourism - Definition, objectives, scope, and significance of agrotourism. History and evolution of agrotourism.	5	["1"]
	1.2	Components in agrotourism- Various elements of agrotourism, agrotourism activities, advantages and challenges of agrotourism	5	["1"]
	1.3	Role of agrotourism in promoting climate-smart agriculture	5	["3"]
2	Agrotourism Business, Planning, and Management (15 hours)			
	2.1	Agrotourism business, planning and management – definition, objectives, need for planning and management	5	["1", "2"]
	2.2	Linking agritourism with farm-to-table experiences, Agro-event hosting: Weddings, wellness retreats, and cultural festivals on farms, Engaging local communities in agrotourism development	5	["2"]
	2.3	Agrotourism planning and business development: Market Analysis and Customer Demographics, design of activities, exploring funding options, preparation of business proposals, partnerships and collaborations, customer feedback, target groups, capacity building, stakeholder engagement, agrotourism auditing, marketing of agrotourism and agriproducts	5	["3"]
3	Agrotourism and Rural Development (15 hours)			
	3.1	Introduction to Agrotourism and Rural Development – definition, scope and significance Popular agrotourism models (e.g., farm stays, vineyard tourism, eco-farms)	5	["2", "4"]
	3.2	Digital marketing and technology in farm tourism Integration of AI and IoT in smart farming tourism	5	["3"]
	3.3	Role of agrotourism in rural development - Economic diversification and job creation, infrastructure development, preservation of cultural heritage, enhancing community participation, promoting sustainable agricultural practices, strengthening local supply chains and markets	5	["2"]

Module	Units	Course Description	Hrs	CO No.
4	Experiential Learning (15 hours)			
	4.1	Visit to a recognized Research Station of Agricultural importance. Observe and analyze agricultural advancements	5	["1", "3"]
	4.2	Visit a farm or factory of agrotourism significance. Observe and analyze its business strategies and agrotourism activities. Prepare a detailed report highlighting key observations and propose suitable business models to enhance its agrotourism potential.	5	["4"]
	4.3	Submit a case study report on Successful agrotourism projects in rural areas	5	["5"]

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, Online 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** • Involvement and responses in class room transactions • Home Assignments • Oral presentation/ Viva/Quiz/Open book test • Field study, Group discussion on a recent research or review article (<5 years) related to the course • 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 – Written 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 ◦ Short answer - (10 out of 12) – 10 × 2 = 20 ◦ PART - B ◦ Short Essays - (8 out of 10) – 8 × 5 = 40 ◦ PART - C ◦ Essays - (1 out of 2) – 1 × 10 = 10

References

- 1. Adams, B. B. (2008). The new agritourism: Hosting community & tourists on your farm. New World Publishing.
- 2. Chawla, R. (2008). Agri-tourism. Sonali Publications.
- 3. Kumar, N. (2024). Agritourism in India: Opportunities and challenges. International Journal of Creative Research Thoughts, 12(5), 151–160.
- 4. Jangale, A. S., & Totre, A. S. (2023). Agri-tourism in India and its potential to promote sustainable rural development. In Emerging trends in agricultural economics and extension (pp. 5–14). KD Publications Pvt. Ltd.
- 5. Mahaliyanaarachchi, R. (2017). Agri tourism: Segment of rural tourism [Kindle edition]. Amazon Kindle Direct Publishing.
- 6. Mandi, K., Azad, A., Dutta, S., & Hindorya, P. S. (2019). Agro-tourism: Exploring new avenues in rural India. Agriallis, 1(1), 7–13.
- 7. Nair, S. (2017). Agritourism in India: Strategies for growth. In B. Varghese (Ed.), Evolving paradigms in tourism and hospitality in developing countries (pp. 150–165). Apple Academic Press.
- 8. Negi, J., & Manohar, G. (2011). Rural tourism: Planning and promotion. Authors Press.

- 9. Parkar, P. R. (2021). Agritourism: Guide for beginners. Walnut Publication.
- 10. Poolsingh, D. (2023, August 9). Scope of agri tourism in India. Krishi Science – eMagazine for Agricultural Sciences, 4(8), 5.
- 11. Ramu, M. S., & Vazhacharickal, P. J. (2022). Agro-tourism in India: Status and prospects. International Journal of Rural Studies, 29(4), 90–98.
- 12. Randall, J. (2012). Agriculture tourism. Discovery Publishing House Pvt. Ltd.
- 13. Salve, S. D., Chavan, K. R., & Mhatre, K. G. (2024). Agrotourism and economics. Mahi Publication.
- 14. Sangma, G. A., & Bandaru, T. R. (2024). Agri-tourism: Bridging agriculture and tourism. Biotech Books Publishers
- 15. Slocum, S. L., & Curtis, K. R. (2017). Food and agricultural tourism: Theory and best practice. Routledge, CBS Publishers & Distributors PVT. LTD
- 16. Somanath, G. (2021). Agri-tourism: The future of agriculture and tourism in India. Indian Farmer, 8(5), 382-386.
- 17. Sznajder, M., Przezbórska, L., & Scrimgeour, F. (2009). Agritourism. CABI Publishing.
- 18. Torres, R., & Momsen, J. (Eds.). (2011). Tourism and agriculture: New geographies of consumption, production and rural restructuring. Routledge.
- 19. Vyas, A. K., & Raj, R. (2021). An introduction to agriculture (8th ed.). Generic Publications.
- 20. Walke, S. G., Yadav, A. K., & Brar, V. (2020). Agrotourism management: A complete practical guide. Lambert Academic Publishing.

Affidavit

- We, Sree Vidyadiraja NSS College, Vazhoor and Dr. Jayakumar K, retain the copyright of this syllabus and expressly prohibit its distribution in complete form to any institution outside our own.
- We, Sree Vidyadiraja NSS College, Vazhoor, agree to appoint a new course coordinator for the proposed Agrobotany 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, Sree Vidyadiraja NSS College, Vazhoor and Dr. Jayakumar K, 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.

MAHATMA GANDHI UNIVERSITY

Kottayam, Kerala

Undergraduate Programmes (HONOURS)
2024 Admission Onwards

SYLLABUS						
SIGNATURE COURSE						
Name of the College	Sree Vidyadiraja NSS College, Vazhoor					
Faculty/ Discipline	Botany					
Programme	BSc (Hons) Botany					
Course Coordinator	Dr. Jayakumar K					
Contributors	Dr. Prita Pillai, Dr. Rani VS, Dr. Supriya R					
Course Name	Agrifood Science and Nanotechnology					
Type of Course	DSE					
Specialization title	Agrobotany					
Course Code	MG4DSEBOTA01					
Course Level	200					
Course Summary	The course combines the principles of agrifood science with the cutting-edge field of nanotechnology. It covers the application of nanotechnology in agriculture, food production, processing and safety emphasizing innovative solutions for enhancing food quality and sustainability.					
Semester	4	**Credits**			4	**Total Hours**
Course Details	**Learning Approach**	Lecture	Tutorial	Practical	Others	
		4				60
Pre-requisites, if any	Nil					

Course Outcomes (CO)

Number of COs		**4**	
CO No.	**Expected Course Outcome**	**Learning Domains ***	**PO No**
1	Identify the different types of agrifood systems and role of nanotechnology in agrifood sector.	K	PO6
2	Discuss the methods of improving food quality using different types of nanomaterials.	U	PO2
3	Evaluate the impact of nanotechnology in agrifood system	E	PO2
4	Apply the principles of nanotechnology in practical, real-world situations and problems	A	PO2, PO3

**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	-	-	-	-

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 2	-	3	-	-	-	-	-	-	-	-
CO 3	-	3	-	-	-	-	-	-	-	-
CO 4	-	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	Introduction to Agrifood Science & Nanotechnology (15 hours)			
	1.1	Definition and components of agrifood systems –Food products that originate from crop and livestock, forestry, fisheries and aquaculture and from other sources for human consumption (any three examples each)	5	["1"]
	1.2	Introduction to nanotechnology-Definition and scope of nanotechnology, types of nanomaterials, Role of nanotechnology in crop production- soil health monitoring –using nanoparticles, Nano-fertilizers and nano-pesticides Plant disease diagnostics-Nano barcodes and nanoprobes	5	["1"]
	1.3	Methods of synthesis of nanoparticles Physical Methods Chemical Methods Green Synthesis	5	["1"]
2	Nanotechnology in agrifood sector (15 hours)			
	2.1	Food Processing and quality enhancement Improved texture and flavour, flavour release regulation Nanoparticles in processing of food-Encapsulation and delivery-nano emulsions, nano liposomes, bilayer vesicles Activity: Make a list of 10 major companies involved in Agricultural Nanotechnology (In and outside India), their products and present the study as PowerPoint presentations	5	["2"]
	2.2	Food safety- Nanosilver particles for providing anti-microbial protection, Detection of pathogens-Magnetic nanoparticles Contaminant detection and removal-Nanofilters (Fruit Juices) Portable nanosensor kits(Gold and Silicon)-Detect gases released during food decomposition Food quality control- Nanobarcodes for track and trace food products	5	["3"]
	2.3	Advantages of green Synthesis of nanoparticles Silver nanoparticles- Green synthesis Hands on training on green synthesis of silver nanoparticles	5	["4"]

Module	Units	Course Description	Hrs	CO No.
3	Food packaging –Role of nanotechnology (15 hours)			
	3.1	Types of nanomaterials used in food packaging- Organic-nanocellulose, protein nanoparticles, chitosan nanoparticles Inorganic-carbon nanotubes, silver nano particles, Benefits of nanomaterials in food packaging Oxygen scavenging packaging-Use of nanosensors; Processing equipment- nanocoating	5	["2"]
	3.2	Smart packaging-RFID (Radio Frequency identification) nanotags Activity: Evaluate the benefits of nanotechnology in food packaging in comparison with the conventional methods – Submission of report	5	["3"]
	3.3	Challenges of nanotechnology in agriculture and allied fields-Toxicity concerns, High cost, scalability, lack of awareness, skill shortage, regulations	5	["3"]
4	Research & Development in the field of Agriculture and Nanotechnology (15 hours)			
	4.1	Role of Government organizations-CeNSE(Centre for Nano Science and Engineering, Bangalaroo) IFFCO- Nano Urea and Nano DAP IARI-Nano-fertilizer, IIT Delhi- nanosensors to monitor soil and crop health	5	["1", "3"]
	4.2	AI guided automation-for correct dosages and applications; large-scale networks of nanosensors; edible nanocoatings; nano enabled urban agriculture.	5	["1", "4"]
	4.3	A visit to any International/national Centre for Nanoscience and Nanotechnology and submit a detailed report.	5	["1", "3"]

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, invited lecture, Discussion-based Learning, Inquiry-Based Learning, Online 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
• Involvement and responses in class room transactions • Home Assignments • Oral Presentation /Viva/Quiz/Open book test • Field study, Group discussion on a recent research or review article(<5 years) related to the course • 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 – Written 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
◦ Short answer - (10 out of 12) – 10 × 2 = 20
◦ PART - B
◦ Short Essays - (8 out of 10) – 8 × 5 = 40
◦ PART - C
◦ Essays - (1 out of 2) – 1 × 10 = 10

References

- 1. Anandharamakrishnan, S., & Parthasarathi, S. (2019). Food nanotechnology- Principles and applications (1st ed.). CRC Press.
- 2. Chattopadhyay, K. K. (2009). Introduction to Nanoscience and Nanotechnology (1st ed.). PHI Learning.
- 3. Giri, N. G., Abbas, N. S., & Shukla, S. K. (2023). Nanotechnology in Agricultural Practices: Prospects and Potential. Materials Research Foundations, 148, 252-275. https://doi.org/10.21741/9781644902554-9.
- 4. Jana, B. L. (2016). Nanotechnology in Agriculture (1st ed.). Pointer Publishers.
- 5. Kashyap, B., & Kumar, R. (2021). Sensing methodologies in agriculture for soil moisture and nutrient monitoring. IEEE Access, 9, 14085-14121. https://doi.org/10.1109/ACCESS.2021.3052478.
- 6. Lakshmanan, A., & Subramanian, K. S. (2020). Nanotechnology in agriculture energy and environment. Daya Publishing House.
- 7. Parthasarathy, B. K. (2007). Introduction to nanotechnology. Isha Books
- 8. Prasad, R., Kumar, V., & Prasad, K. S. (2014). Nanotechnology in sustainable agriculture: Present concerns and future aspects. African Journal of Biotechnology, 13(6), 705–713
- 9. Roy, S., & Hossain,A. (2024). The nanotechnology driven agriculture: The future ahead. CRC Press (Taylor & Francis Group).
- 10. Sekhon, B. S. (2014). Nanotechnology in agri–food production: An overview: Nanotechnology, Science and Applications, 7, 31–53. https://doi:10.2147/NSA.S39406
- 11. Shikha., Singh, S., & Singh, S. (2025). The handbook of nanotechnology in food science and nutrition: Enhancing safety, quality and health. AkiNik Publications. https://doi.org/10.22271/ed.book.3081
- 12. Singh, P., Anam., Srivastava, T. K., & Verma, R. R. (2022). Nanoparticles Applications in Agriculture (1st ed.). Scientific Publishers. ISBN- 978-93-9141-822-9.
- 13. Singh, R., & Kumar, S. (2023). Nanotechnology advancement in agro-food industry. Springer Singapore. https://doi.org/10.1007/978-981-99-5045.
- 14. Subramanian, K. S., Gunasekaran, K., Natarajan, N., Chinnamuthu, C. R., Lakshman, A., & Rajkishore, S. K. (2015). Nanotechnology in agriculture. NIPA. ISBN: 978-93-8330-520-9.
- 15. Vuong, L. D. (2019). Nanoparticles for the improved crop production. In D. Panpatte & Y. Jhala (Eds.), Nanotechnology for agriculture: Crop production & protection (pp. 85-106). Springer, Singapore. https://doi.org/10.1007/978-981-32-9374-8_5

Suggested Readings

- 1. Ingle, A. P. (2023). Nanotechnology in agriculture and agro ecosystems (1st ed.). Elsevier. https://doi.org/10.1016/C2021-0-01647-3

Affidavit

- We, Sree Vidyadiraja NSS College, Vazhoor and Dr. Jayakumar K, retain the copyright of this syllabus and expressly prohibit its distribution in complete form to any institution outside our own.
- We, Sree Vidyadiraja NSS College, Vazhoor, agree to appoint a new course coordinator for the proposed Agrobotany 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, Sree Vidyadiraja NSS College, Vazhoor and Dr. Jayakumar K, 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.

MAHATMA GANDHI UNIVERSITY

Kottayam, Kerala

Undergraduate Programmes (HONOURS)
2024 Admission Onwards

SYLLABUS						
SIGNATURE COURSE						
Name of the College	Sree Vidyadiraja NSS College, Vazhoor					
Faculty/ Discipline	Botany					
Programme	BSc (Hons) Botany					
Course Coordinator	Dr. Jayakumar K					
Contributors	Dr. Rajesh MG, Dr. Rani VS, Dr. Supriya R					
Course Name	Agrobotany of plantation crops and spices					
Type of Course	DSE					
Specialization title	Agrobotany					
Course Code	MG5DSEBOTA01					
Course Level	300					
Course Summary	This course is designed to acquaint students • With the production technologies, economic importance, and management practices of major plantation crops like Coconut, Coffee, Rubber, Tea. • With the production technologies, economic importance, and management practices of major spice crops like Cardamom, Clove, Pepper and Turmeric.					
Semester	5	**Credits**			4	**Total Hours**
Course Details	**Learning Approach**	Lecture	Tutorial	Practical	Others	
		4				60
Pre-requisites, if any	Nil					

Course Outcomes (CO)

Number of COs		**5**	
CO No.	**Expected Course Outcome**	**Learning Domains ***	**PO No**
1	Identify the various practices involved in cultivation and management of selected plantation crops and spices	K	PO1
2	Familiarize seeds of plantation crops and spices with their plant types in their natural existence	U	PO2
3	Classify selected plantation crops and spices according to their agro-climatic requirement, physiological and morphological features	AN	PO1
4	Practice techniques involved in management of selected plantation crops and spices	E	PO2, PO3
5	Learn the harvesting stages of selected plantation crops and spices; analyse different elements responsible for the deterioration of the harvest; learn the different post-harvest treatments of the crops to reduce post-harvest losses; explain different storage, packaging and transportation methods.	A	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	-	-	-	-	-	-	-	-	-
CO 2	-	3	-	-	-	-	-	-	-	-
CO 3	3	-	-	-	-	-	-	-	-	-
CO 4	-	3	2	-	-	-	-	-	-	-
CO 5	-	-	-	-	-	-	-	-	-	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	Plantation Crops, Spices and their importance (15 hours)			
	1.1	Classification of spices. Importance of spices industry in India. Plantation crops and their importance of in the economy of India	5	["1", "3"]
	1.2	Study of the botany of spices: Cardamom, Clove, Pepper and Turmeric.	5	["2", "3"]
	1.3	Study of the botany of plantation crops: Coconut, Coffee, Rubber, Tea. Characteristics for cultivar selection.	5	["2", "3"]
2	Crop propagation (15 hours)			
	2.1	Methods of propagation of the above crops In vitro methods of rapid multiplication of the above crops.	5	["1", "4"]
	2.2	Seedling rearing of the above crops.	5	["1", "4"]
	2.3	Field Visit: Visit to a local agricultural research station to observe crop propagation/breeding practices.	5	["1", "4"]
3	Cultivation (15 hours)			
	3.1	Agronomic practices of the crops mentioned: a) soil and climate; b) land preparation and planting techniques	5	["1", "3"]
	3.2	Agronomic practices of the crops mentioned: a) micro and macronutrients- management of fertilizers	5	["1", "3"]
	3.3	Agronomic practices (regular and organic) of the crops mentioned: a) organic manure- green manure, compost, farmyard manure; b) chemical fertilizers- nitrogen, potassium and phosphorus c) Biofertilizers	5	["1", "3"]
4	Disease management, harvesting & processing (15 hours)			
	4.1	Major pests and diseases of the crops mentioned earlier. Phytopathology of the crops mentioned earlier. Plant protection (regular and organic), Integrated Pest Management	5	["3", "5"]
	4.2	A brief study of the medicinal properties of the spices mentioned earlier and nutraceuticals made from them.	5	["5"]
	4.3	Postharvest processing technology of the crops mentioned earlier. Quality Control. Testing for content, mycotoxins, bacteria, pesticide residue and adulterants. Standards, specifications and grading of produce.	5	["5"]

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Field-based collection and interactions, Interactive lectures, Lecture-based learning, Project-based Learning, Experimental Learning, Peer Teaching, Invited Lecture, Discussion-based Learning, Inquiry-Based Learning, Online 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** ● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article(<5 years) related to the course ● 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 – Written 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 ∘ Short answer - (10 out of 12) – 10 × 2 = 20 ∘ PART - B ∘ Short Essays - (8 out of 10) – 8 × 5 = 40 ∘ PART - C ∘ Essays - (1 out of 2) – 1 × 10 = 10

References

- 1. Alexander A. et al. (2009). The Adhoc Package of Practices Recommendations for Organic Farming. Kerala Agricultural University Thrissur – 680 651, Kerala, India.
- 2. Child, R. (1974). Coconuts (Edn. 2). Longman Group Ltd., London.
- 3. Dashora, L. K., Dashora, A. & Lakhawat, S.S. (2006). Production Technology of Plantation Crops, Spices, Aromatic and Medicinal Plants. Agrotech Publishing academy, Udaipur, Rajasthan, India.
- 4. Estelitta, S. (2016). Package of Practices Recommendations: Crops 2016 (15th Edition). Kerala Agricultural University, Thrissur – 680 651, Kerala, India.
- 5. Kumar, N (1997). Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants. Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi, India.
- 6. Mohanan, K.V (2006). Essentials of Plantation Science. Penta Books Publishers and distributors, Calicut, Kerala, India.
- 7. Narayanan, P. K. (1976). Rubber and its cultivation. Rubber Board, Kottayam.
- 8. Parthasarathy, V. A., Bhat, A. I. & Parthasarathy. U. (2008). Spice Crops Volume 1 and 2. Today & Tomorrow's Printers and Publishers, New Delhi, India.
- 9. Parthasarathy, V.A., Chattopadhyay, P. K. & Bose, T. K. (2006) (Eds.). Plantation Crops, Vol. 2. Naya Udyog, Kolkata.
- 10. Pillai, K. M. (1986). A Text Book of Plantation Crops. Vikas Publishing House Pt. Ltd., New Delhi, India.
- 11. Singh, J. (2008). Spices and Plantation Crops. Pointer Publishers.

Affidavit

- We, Sree Vidyadiraja NSS College, Vazhoor, agree to appoint a new course coordinator for the proposed Agrobotany 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, Sree Vidyadiraja NSS College, Vazhoor and Dr. Jayakumar K, 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.

MAHATMA GANDHI UNIVERSITY

Kottayam, Kerala

Undergraduate Programmes (HONOURS)
2024 Admission Onwards

SYLLABUS						
SIGNATURE COURSE						
Name of the College	Sree Vidyadiraja NSS College, Vazhoor					
Faculty/ Discipline	Botany					
Programme	BSc (Hons) Botany					
Course Coordinator	Dr. Jayakumar K					
Contributors	Dr. Rajesh MG, Dr. Supriya R					
Course Name	Agricultural microbiology					
Type of Course	DSE					
Specialization title	Agrobotany					
Course Code	MG6DSEBOTA01					
Course Level	300					
Course Summary	This course offers a comprehensive overview of the role of microorganisms in agriculture, focusing on their ecological, functional, and biotechnological aspects. It explores the diversity of soil and plant-associated microbes, their interactions with plants, and their crucial roles in nutrient cycling and soil fertility. Key topics include the practical applications of microbes in disease management, biofertilizers, and in bioremediation. The curriculum offers practical insights into the procedures for isolating, identifying, and characterizing microorganisms, along with knowledge on techniques such as DNA extraction, PCR, and related methods. Students will also learn to analyse and interpret microbial genomes, studying plant-microbe interactions, and managing environmental data with bioinformatics tools also. This course equips students with the skills to apply microbiological principles in agricultural settings, preparing them for careers in agricultural science, environmental microbiology, and related fields, emphasizing innovation and practical problem-solving.						
Semester	6	**Credits**			4	**Total Hours**
Course Details	**Learning Approach**	Lecture	Tutorial	Practical	Others	
		3		1		75
Pre-requisites, if any	Understanding of fundamental biological concepts, basic knowledge on general microbiology					

Course Outcomes (CO)

Number of COs		**4**	
CO No.	**Expected Course Outcome**	**Learning Domains ***	**PO No**
1	Demonstrate the significance of soil microbial diversity in nutrient cycling, soil fertility, and ecological functions within agroecosystems	E	PO1, PO2, PO3, PO9
2	Analyze plant-microbe interactions and develop integrated disease management strategies using biological control agents.	AN	PO1, PO2, PO3, PO9
3	Assess microbial biotechnology approaches, including bioinoculants, molecular, and bioinformatics tools, to enhance agricultural sustainability and pathogen detection.	E	PO1, PO2, PO3, PO7, PO9

Number of COs		4	
CO No.	**Expected Course Outcome**	**Learning Domains ***	**PO No**
4	Utilize the microbial and biotechnological approaches for bioremediation, pathogen detection, water quality assessment, and plant growth promotion in agriculture.	AN	PO1, PO2, PO3, PO7, PO9

**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	-
CO 2	3	3	3	-	-	-	-	-	3	-
CO 3	3	3	3	-	-	-	3	-	3	-
CO 4	3	3	3	-	-	-	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	Soil Microbiology and Nutrient Cycling (15 hours)			
	1.1	Introduction to soil microbiology: Scope and importance in agriculture, soil as a habitat for microorganisms Microbial diversity in soil: Bacteria, fungi, actinomycetes, and protozoa, microbial community structure and functions and isolation methods (streak plate and pour plate methods)	5	["1"]
	1.2	Microbes and ecological nutrient recycling Nitrogen cycle, Carbon cycle, Phosphorous cycle and sulphur cycle	5	["1"]
	1.3	Role of microorganisms in soil health: Brief account on soil fertility and plant growth promotion, Agro-beneficial Rhizobacteria, and other symbiotic plant growth microbes Impact of agricultural practices on soil microbiology- Fertilizers, pesticides, crop rotation and tillage	5	["1"]

Module	Units	Course Description	Hrs	CO No.
2	Plant-Microbe Interactions and Pathology (15 hours)			
	2.1	Microbial pathogens of plants: Characteristics of major bacterial, fungal, viral, and nematode pathogens in plants Disease cycle and infection Brief on plant immune responses and defense mechanisms – Pattern Triggered Immunity (PTI) and Effector Triggered Immunity (ETI), Major defence pathways in plants – Salicylic acid and jasmonic acid mediated pathways (in brief)	5	["2"]
	2.2	Microbial strategies for disease suppression: Antagonistic microorganisms (Pseudomonas fluorescens); Mycoparasitism (Trichoderma viride); Predation: (Lysobacter enzymogenes - predatory activity on fungal pathogens); Microbial metabolites in biocontrol - Production of lytic enzymes and secondary metabolites to suppress pathogens (Serratia marcescens)	5	["3"]
	2.3	Introduction of diagnostic techniques in plant pathology: Brief on ELISA, PCR - qPCR, and DNA barcoding Introduction of essential bioinformatics tools – Brief on important tools for studying plant-microbe interactions, analyzing microbial genomes, and managing environmental data – MetaPhlAn, BlastX and BLASTN, QIIME 2, MG-RAST, Fungene, PathogenFinder, Geneious Prime (Brief study only)	5	["3"]
3	Environmental and Applied Microbiology (15 hours)			
	3.1	Bioremediation in agriculture: Brief on Microbial degradation of pollutants – petroleum hydrocarbons, pesticides, plastics comprising polyethylene, polypropylene, and polyvinyl chloride	5	["4"]
	3.2	Integrated disease management approaches - Development and application of biopesticides – Bacillus subtilis, Beauveria bassiana Techniques for bioremediation of soils and water – phytoremediation, bioaugmentation, biostimulation	5	["4"]
	3.3	Microbial biotechnology in agriculture - Use of genetically modified organisms (GMOs), Microbial inoculants and their applications	5	["4"]
4	Practical (30 hours)			
	4.1	DNA isolation from the plant rhizosphere for metagenomic applications	6	["3"]
	4.2	Detection and diagnosis of plant pathogens - isolation of pathogens from infected plant tissues and microscopic examination	6	["4"]
	4.3	Microbial assessment of irrigation and drinking water through MPN method	6	["4"]
	4.4	Assess the ability of Trichoderma spp. and Pseudomonas fluorescens to inhibit plant pathogens (Fusarium spp., Xanthomonas spp.) through volatile compound production using a sealed plate assay	6	["4"]
	4.5	Screening procedure for plant growth-promoting microbes Isolation and characterization of Rhizobium (staining)	6	["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, invited lecture, group discussions, Discussion-based Learning, Inquiry-Based Learning, Online 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** • Involvement and responses in class room transactions • Home Assignments/preparedness • Oral presentation/Viva/Quiz/Open book test/written test • Field study report /Group discussion on recent research or review article (≤ 5 years) related the course • Any other method as may be required for specific course/student by the course faculty **• Practical – 15 Marks** • Lab involvement and practical skills • Record/Any other method as may be required for specific course / student by the course faculty **B. End Semester Evaluation (ESE)** **• Theory – 50 Marks** Assessment Methods – Written 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 ∘ Short answer - (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 assessments (30 marks), Record (5 marks) Duration of Examination – 2.00 Hrs

References

- 1. Rangaswami, G., & Bagyaraj, D. J. (2005). Agricultural microbiology (2nd ed.). Prentice Hall of India.
- 2. Alvarez, P. J., & Illman, W. A. (2005). Bioremediation and natural attenuation: Process fundamentals and mathematical models. Wiley-Interscience.
- 3. Pepper, I. L., Gerba, C. P., & Gentry, T. J. (2015). Environmental microbiology (3rd ed.). Academic Press.
- 4. Glazer, A. N., & Nikaido, H. (2007). Microbial biotechnology: Fundamentals of applied microbiology (2nd ed.). Cambridge University Press.
- 5. Atlas, R. M., & Bartha, R. (1998). Microbial ecology: Fundamentals and applications (4th ed.). Benjamin-Cummings Publishing Company.
- 6. Tortora, G. J., Funke, B. R., & Case, C. L. (2015). Microbiology (12th ed.). Pearson.
- 7. Van Elsas, J. D., Trevors, J. T., & Wellington, E. K. (2006). Modern soil microbiology (2nd ed.). CRC Press.
- 8. Agrios, G. N. (2005). Plant pathology (5th ed.). Elsevier Academic Press.
- 9. Stacey, G., & Keen, N. T. (Eds.). (1997). Plant-microbe interactions (Vol. 6). Springer.
- 10. Lugtenberg, B. (Ed.). (2015). Principles of plant-microbe interactions: Microbes for sustainable agriculture. Springer.
- 11. Paul, E. A. (2015). Soil microbiology, ecology, and biochemistry (4th ed.). Academic Press.
- 12. Tate, R. L. (2000). Soil microbiology (2nd ed.). Wiley.
- 13. Mount, D. W. (2004). Bioinformatics: Sequence and genome analysis. Cold Spring Harbor Laboratory Press.
- 14. Grotewold, E. (Ed.). (2008). Plant functional genomics: Methods and protocols. Springer Science & Business Media

Suggested Readings

- 1. Madigan, M. T., Bender, K. S., Buckley, D. H., Sattley, W. M., & Stahl, D. A. (2021). Brock biology of microorganisms (16th ed.). Pearson.
- 2. Singh, A., Ward, O. P., & Kuhad, R. C. (Eds.). (2011). Advances in applied bioremediation. Springer.
- 3. Sylvia, D. M., Fuhrmann, J. J., Hartel, P. G., & Zuberer, D. A. (2005). Principles and applications of soil microbiology (2nd ed.). Pearson Prentice Hall.
- 4. Gupta, V. K., Schmoll, M., Maki, M., Tuohy, M., & Mazutti, M. A. (Eds.). (2013). Applications of microbial engineering (1st ed.). CRC Press.
- 5. Lugtenberg, B. (Ed.). (2016). Beneficial microbes in agro-ecology: Bacteria and fungi. Springer.
- 6. Willey, J. M., Sandman, K., & Wood, D. (2019). Prescott's microbiology (11th ed.). McGraw-Hill Education.
- 7. Pelczar, M. J., Chan, E. C. S., & Krieg, N. R. (1993). Microbiology: Concepts and applications. McGraw-Hill.

Affidavit

- We, Sree Vidyadiraja NSS College, Vazhoor and Dr. Jayakumar K, retain the copyright of this syllabus and expressly prohibit its distribution in complete form to any institution outside our own.
- We, Sree Vidyadiraja NSS College, Vazhoor, agree to appoint a new course coordinator for the proposed Agrobotany 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, Sree Vidyadiraja NSS College, Vazhoor and Dr. Jayakumar K, 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.