

Lecture Plan		
Name of the college: Government College of Arts, Science and Commerce, Sanquelim, Goa.		
Name of Faculty: Ms. Shubha Shivdas Kauthankar	Subject: Botany	
Paper code: BOT 204- Biofertilizers	Program: S.Y.B.Sc.	Division: -
Academic year: 2024- 2025	Semester: IV	Total Lectures: 30
Course Objectives: 1. Introduce the concept of biofertilizers and elucidate the benefits of their application. 2. Provide knowledge about the various types of biofertilizers and the organisms used in their formulations. 3. Familiarise students with the principles and practices of organic farming and its role in sustainable crop production.		
Course Outcome: 1. To recall the concept of biofertilizers, types of biofertilizers, isolation, mass multiplication, formulations and methods of field application in organic agriculture. 2. Develop skills in preparation of biofertilizer formulations for management of crops in a cost-effective and eco-friendly manner. 3. Integrate the acquired knowledge for sustainable crop production, welfare of society and employment generation.		
Student Learning Outcome: 1. Recall the concept of biofertilizers 2. Explain the types of biofertilizers, isolation, mass multiplication, formulations and methods of field application and benefits associated with use of biofertilizers in organic agriculture. 3. Develop skills in preparation of biofertilizer formulations for management of crops in a cost-effective and eco-friendly manner. 4. Integrate the acquired knowledge for sustainable crop production, welfare of society and employment generation.		

Month	Lecture From	Lecture To	No. of lectures allotted	Topic, Subtopic to be covered	Exercise/ Assignment	ICT Tools	Reference books
December 2024	09/12/2024	14/12/2024	2	Module 1: Introduction to biofertilizers, phosphate solubilizing microbes and mycorrhizae as biofertilizers	To list various types of microorganisms used in biofertilizers	-	Dubey, RC (2005). A Text Book of Biotechnology. S. Chand & Company, New Delhi.
				Introduction to biofertilizers: Concept of biofertilizers.			
December 2024	16/12/2024	21/12/2024	2	Various types of microbes used as biofertilizers	To study different types of carrier materials	-	Dubey, RC and Maheshwari, DK (2012). Practical Microbiology. 3rd revised edition. S. Chand & Company, New Delhi.
				Carrier materials - types and quality characteristics of an ideal carrier			
January 2025	06/01/2025	11/01/2025	2	Role of effective microorganisms and Plant Growth Promoting Rhizobacteria (PGPR).	To list the role of PGPR	-	Bukhari, MJ and Rodrigues, BF (2006). Techniques in Mycorrhizae. Government College, Quepem, Goa.
				Role of effective microorganisms and Plant Growth Promoting Rhizobacteria (PGPR).			
January 2025	13/01/2025	18/01/2025	2	Mode of action; benefits and limitations of usage of biofertilizers.	To list the examples of phosphate solubilizing bacteria	-	
				Phosphate solubilizing microbes: Occurrence, isolation, mass production and field application.			
January 2025	20/01/2025	25/01/2025	2	ISA 01- Assignment	To categorise and write the characteristics of mycorrhiza types		
				Mycorrhizae as biofertilizers: Types of mycorrhizal association and their characteristics			

January/ February 2025	27/01/2025	01/02/2025	2	Significance of mycorrhizae in forestry and agriculture	To enlist the function of mycorrhizae	Powerpoint presentation	Rakshit, A, Meena, VS, Parihar, M, Singh, HB and Singh, AK (Eds.) (2021). Biofertilizers: Volume 1 - Advances in Bio-inoculants. Elsevier, U.K.
				Ectomycorrhizae as biofertilizers			
February 2025	03/02/2025	08/01/2025	2	Arbuscular Mycorrhizal (AM) fungi - isolation, mass production and field application.	To summarise the method of AM fungi mass production		
				Arbuscular Mycorrhizal (AM) fungi - isolation, mass production and field application.			
February 2025	10/02/2025	15/01/2025	2	Module 2: Nitrogen fixing microbes Symbiotic nitrogen fixing microbes:	-	-	Rodrigues, BF and Muthukumar, T (2009). Arbuscular Mycorrhizae of Goa - A Manual of Identification Protocols. Goa University, Goa.
				Rhizobium-root nodule symbiosis; identification, isolation, 15 hours mass multiplication.			
February 2025	17/02/2025	22/01/2025	2	production of carrier-based inoculants	-		
				Techniques of field application and crop response to rhizobial inoculants			
February/ March 2025	24/02/2025	01/03/2025	2	Frankia and actinorrhizal symbiosis		-	
				ISA 02 (Written test)			
March 2025	03/03/2025	08/03/2025	2	Free living nitrogen-fixing microbes: Cyanobacteria - diversity, identification, isolation	To study the technique of inoculum preparation	-	
				Inoculum preparation, techniques of field application and crop response to cyanobacterial inoculants.			

March 2025	10/03/2025	15/03/2025	2	Azospirillum: identification, isolation,		-	
				Azospirillum: mass multiplication,			
March 2025	17/03/2025	22/03/2025	2	Azolla-Anabaena symbiosis; mass cultivation and field application of Azolla and its role as a green manure-cum-biofertilizer.	To write the method of Azolla mass cultivation	-	
				Production of carrier-based inoculants, techniques of field application and crop response.			
March 2025	24/03/2025	29/03/2025	2	Azotobacter -identification, isolation, mass multiplication, production of carrier-based inoculants.	To write the method of Azotobacter isolation	-	
				Azotobacter- techniques of field application and crop response.			
March/ April 2025	31/03/2025	05/04/2025	2	Algalization technology.	-	-	
April 2025	07/03/2025	11/04/2025	2	Revision	-	-	

*** Assessment Rubrics**

Component	Max Marks
ISA 1	7.5
ISA 2	7.5
ISA 3	7.5
Practical	25
Project	-
Semester End Exam	60

