

## GENERIC ELECTIVES (BOT-GE-2)

### Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical/Practice		
<b>Biofertilizers</b> BOT-GE-2	4	2	0	2	-	Nil

### Learning Objectives

The Learning Objectives of this course are as follows:

- To develop an understanding of biological systems used as fertilizers and build skills in handling microbial inoculants.
- To understand the optimum conditions for growth and multiplication of useful microbes such as *Rhizobium*, cyanobacteria, mycorrhizae, *Azotobacter* etc.
- To understand the role of microbes in mineral cycling and nutrition of plants.
- To gain expertise in various methods of decomposition of biodegradable waste, conversion into compost and apply this knowledge and skill in their daily life.

### Learning outcomes

On successful completion of this course, a student will be able to:

- visualize and identify different types of microorganisms with a compound microscope.
- understand the classification of microorganisms according to their shape/ structure for morphological identification. Prepare and sterilize different types of culture media.
- isolate of microorganisms from the environmental samples and culture in aseptic conditions.

## **SYLLABUS OF BOT-BOT-GE-2**

### **Unit 1: Introduction**

**Weeks: 3.5**

Introduction to microbial inoculants or biofertilizers, macro and micro-nutrition of plants, chemical fertilizers versus biofertilizers; Methods and steps in mass multiplication of biofertilizers: stock culture, broth culture, growth medium, fermentation, blending with the carrier, packaging, and quality check, ISI standard specification for biofertilizers; scope of biofertilizers in India.

### **Unit 2: Microbial Inoculants**

**Weeks: 04**

Study of important microbial inoculants: *Rhizobium*, *Azospirillum*, *Azotobacter*, *Actinorhizae*; Characteristics, isolation, identification, and crop response.

### **Unit 3: Role of Cyanobacteria**

**Week: 01**

Role of Cyanobacteria (blue-green algae) in rice cultivation; *Azolla* and *Anabaena azollae* association, nitrogen fixation, and factors affecting growth.

### **Unit 4: Mycorrhizal association**

**Weeks:**

**04**

Types of mycorrhizal association, taxonomy, occurrence and distribution; Role of Arbuscular mycorrhizal fungi in phosphorus nutrition, growth and yield of crop plants; AMF – methods in isolation (wet sieving and decanting), identification (morphological and molecular methods). Methods of inoculum production (Pot culture and root culture).

### **Unit 5: Organic farming**

**Weeks: 2.5**

Introduction to organic farming, recycling of biodegradable municipal (domestic), agricultural and industrial waste; green manuring, bio-composting, vermicomposting and their field application.

**Practicals:**

1. Study of *Rhizobium* from root nodules of leguminous plants by Gram staining method. (Week: 01)
2. Observation of arbuscular mycorrhizal fungi from plant roots. (Weeks: 02)
3. Isolation of arbuscular mycorrhizal spores from rhizosphere soil. (Week: 01)
4. Isolation of *Anabaena* from *Azolla* leaf. (Week: 01)
5. Study of Earthworm, *Azolla*, AMF: Arbuscules-vesicles through specimen / digital resources. (Week: 01)
6. Study of Biocontrol methods and their application -Pheromone trap, *Trichoderma*, *Pseudomonas*, Neem etc. through digital resources. (Week: 01)
7. Rapid test for pH,  $\text{NO}_3^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{Cl}^-$  and organic matter of different composts. (Weeks: 02)
8. Projects on any one of the following topics: *Rhizobium* technology, AMF technology, Organic farming, Bio composting, Vermicomposting, *Azolla* culture etc. (The design of the project should be such that it includes a continuous work of at least 6 weeks and a dissertation submission). (Weeks: 06)

#### **Essential/recommended readings:**

1. Kumaresan, V. (2005). Biotechnology. New Delhi, Delhi: Saras Publication.
2. Sathe, T.V. (2004). Vermiculture and Organic Farming. New Delhi, Delhi: Dayapublishers.
3. Subha Rao, N.S. (2020). Soil Microbiology, 5th edn. New Delhi, Delhi: Oxford & IBH Publishers.
4. Reeta Khosla (2017). Biofertilizers and Biocontrol Agents for Organic Farming, Kojo Press

#### **Suggestive readings:**

1. *Azotobacter* - Isolation and characterization - <https://youtu.be/1Z1VhgJ2h6U>
2. *Rhizobium* - Identification and characterization - <https://youtu.be/jELlo-pMvc4>.
3. 3-Days Online Workshop On Arbuscular Mycorrhizal Fungi - Biodiversity,

Taxonomy and Propagation 19-2 (2022-01-20 at 02\_27 GMT-8) -

<https://youtu.be/LKzK4IuSRc4>.

4. Vayas, S.C, Vayas, S., Modi, H.A. (1998). Bio-fertilizers and organic Farming. Nadiad, Gujarat: Akta Prakashan.