

**MAHARAJA GANGA SINGH UNIVERSITY**  
**NH-15, Jaisalmer Road, Bikaner-33404**

**Certificate in Biofertilizer Production**

1. **Eligibility:** 10+2 with science with Biology/ Biotechnology/Agriculture /Horticulture as one of the subjects
2. **Duration: 1 Year (2 Semesters)**
3. **Total Credits: 24**
4. **Course Objectives:**

1. To provide theoretical and practical knowledge of biofertilizer types, production, and application.
2. To develop skills in microbial strain selection, mass production, formulation, quality control, and commercialization.
3. To promote sustainable agricultural practices and entrepreneurship.

1. **Course Outcomes:**

Upon successful completion of this diploma course, learners will be able to:

**CO1.** Demonstrate foundational knowledge of beneficial soil microorganisms and their roles in nutrient cycling and plant growth.

**CO2.** Differentiate between various types of biofertilizers (e.g., nitrogen fixers, phosphate solubilizers, mycorrhizae).

**CO3.** Prepare solid and liquid formulations using appropriate carriers and additives.

**CO4.** Apply standardized methods for quality testing, including CFU count, contamination assessment, pH, and moisture content.

**CO5.** Recommend and execute correct methods of biofertilizer application (e.g., seed, soil, or foliar).

**CO6.** Interpret and apply BIS, FCO, and ISO standards in biofertilizer production.

**CO7.** Maintain documentation required for legal compliance, labelling, and licensing.

**CO8.** Develop Entrepreneurial Skills for Agri-Biotech Ventures by designing a business plan for setting up a small-scale biofertilizer production unit.

**CO9.** Understand funding avenues, raw material sourcing, cost estimation, and marketing strategies.

**CO10.** Conduct Independent Research and Field Projects by planning and executing project work or doing internships related to biofertilizer development or field application.

## Structure of Programme

| Paper Code           | Paper Name                               | Lecture | Tutorial | Practical/<br>Field<br>exercise/In<br>ternship | Total<br>Credits | Maximum<br>Marks         | Minimum Passing<br>Marks (%) |
|----------------------|--|---------|----------|--|------------------|--------------------------|------------------------------|
| <b>Semester-I</b>    |  |         |          |  |                  |                          |                              |
| <b>Papers</b>        |  |         |          |  |                  |                          |                              |
| DPBT 101             | Introduction to Biofertilizers           | 1       | 1        | 0  | 2                | 20                       | 36 %                         |
| DPBT 102             | Production Techniques for Biofertilizers | 1       | 1        | 2  | 4                | 20                       | 36 %                         |
| DPBT 103             | Downstream Processing and Formulation    | 1       | 1        | 1  | 3                | 20                       | 36 %                         |
| DPBT 104             | Quality Control and Certification        | 1       | 1        | 1  | 3                | 20                       | 36 %                         |
| <b>Semester-II</b>   |  |         |          |  |                  |                          |                              |
| DPBT 201             | Field Application Methods                | 0       | 1        | 1  | 2                | 20                       | 36 %                         |
| DPBT 202             | Entrepreneurship and Marketing           | 1       | 1        | 0  | 2                | 20                       | 36 %                         |
| DPBI 203             | Internship/ Industrial Training          | 0       | 0        | 4  | 4                | 40                       | 36%                          |
| BPBPW/D 204          | Project Work/ Dissertation*              | 0       | 0        | 4  | 4                | 40                       | 36 %                         |
| <b>Total Credits</b> |  |         |          |  | <b>24</b>        | <b>Grand Total = 200</b> |                              |

\* Project Work/ Dissertation shall be evaluated by an External Examiner

## **1. Course Structure:**

### **Module 1 (DPBT 101). Introduction to Biofertilizers**

1. Introduction to soil microbiology
2. Concept of plant-microbe interactions
3. Types of biofertilizers (Nitrogen fixers, Phosphate solubilizers, Potash mobilizers, Mycorrhizae, etc.)
4. Role in sustainable agriculture

### **Module 2 (DPBT 102). Production Techniques for Biofertilizers**

1. Isolation and screening of efficient strains
2. Culture media and growth conditions
3. Lab-scale biofertilizer manufacturing
4. Storage, packaging and distribution
5. Biofertilizer application in crops

### **Module 3 (DPBT 103): Downstream Processing and Formulation**

1. Biomass harvesting, drying, and blending
2. Carrier materials (peat, lignite, vermiculite, liquid formulations)
3. Formulation technology
4. Shelf-life enhancement

### **Module 4 (DPBT 104): Quality Control and Certification**

1. BIS/ISO/ICAR standards for biofertilizers
2. Viability tests, contamination checks, CFU count
3. Labelling and packaging norms
4. Regulatory requirements for commercialization

### **Module 5 (DPBT 201): Field Application Techniques**

5. Application methods (seed treatment, soil, drip irrigation)
6. Crop-specific recommendations
7. Biofertilizer compatibility with chemical inputs
8. Performance monitoring

### **Module 6 (DPBT 202): Entrepreneurship and Marketing**

1. Setting up a biofertilizer production unit
1. Raw material sourcing
2. Business models, funding, licensing

3. Market linkages and government schemes

**Module 7 (DPBI 203): Internship/ Industrial Training**

1. Lab/Industrial training: media preparation, culture maintenance, inoculum development
2. Production and QC exercises
3. Visit to commercial biofertilizer plants
4. Interaction with agri-startups

**Module 8 (BPBPW/D 204): Project Work / Dissertation (4 Credits)**

1. Research or industrial project
2. Focused on a specific strain, process optimization, or field trial
3. Final report submission and viva

**Suggested Practical**

1. Sterilization techniques: Autoclaving, dry heat sterilization, and filter sterilization.
2. Preparation of nutrient media: Nutrient agar, YEMA, Pikovskaya's agar, Jensen's medium.
3. Isolation of microorganisms from soil: Serial dilution and spread plate method.
4. Colony morphology and Gram staining
5. Microscopic observation of bacterial spores and fungal structures
1. Isolation and identification of:
  1. *Rhizobium* from root nodules
  2. *Azotobacter* and *Azospirillum* from soil
  3. Phosphate solubilizing bacteria (PSB) from rhizosphere
  4. Vesicular-arbuscular mycorrhiza (VAM) from soil and roots
6. Staining of root nodules and VAM spores
7. Nodulation test in leguminous plants
8. Mass cultivation in flasks and fermenters (small-scale setup)
9. Carrier preparation (peat, lignite, charcoal, etc.) and sterilization
10. Inoculum mixing and packing into carrier material
11. Preparation of liquid biofertilizers with stabilizers
12. Viable count determination (CFU/ml or CFU/g) using serial dilution
13. Contamination checking in biofertilizer formulations
14. pH, moisture content, and shelf-life testing
15. Bioassay of biofertilizer efficacy on seedlings (growth chamber or greenhouse)

16. Seed treatment and coating with biofertilizers
17. Root dipping and soil application methods
18. Preparation of inoculant consortia for specific crops
19. Field visit to biofertilizer production unit or certified organic farm

#### **Suggested Reading**

1. Subba Rao, N.S. (2017). *Biofertilizers in Agriculture*.
2. Kannaiyan, S. (2002). *Biofertilizers for Sustainable Agriculture*.
3. Recent ICAR & FCO guidelines
4. Research articles from journals like *Applied Soil Ecology*, *World Journal of Microbiology & Biotechnology*, etc.