# Vocational/Skill Development Course

# On

# Biofertilizers

**(For B.Sc. BOTANY)**

**[AS PER NATIONAL EDUCATION POLICY (NEP)-2020]**

**FACULTY OF SCIENCE**

**2023**

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**Principal,**
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**Director, USERC**

11.07.23

# Sri Dev Suman Uttarakhand University, Badsahithaul, Tehri (Garhwal), Uttarakhand

## Vocational/Skill Development Courses

## Course title: Biofertilizers

### Learning objective:

This course aims to give the student an overview of :

- Biofertilizers and its mechanism of action on plant system.
- Describe Production steps of different Biofertilizers.
- Explains Mode of application of various Biofertilizers .
- Explains about organic farming and biopesticides.

### Course Outcomes:

The salient features of this programme are :

- To emphasize the overall development of student with major focus on biofertilizer industries etc.
- To make skilled manpower for Biofertilizer industry
- Course can generate opportunities of self-entrepreneurship among students .
- Students will get many opportunities of interactions with experts in these fields during the course tenure.
- The students can gain hands on experience in the field while doing interactions with industries, research institutes, etc.

# Course title: Biofertilizers

| Programme/Class: Certificate in Science | Year: First | Semester: First |
|---|---|---|
| Paper- Theory Subject: Vocational/Skill Development Course | | |
| Course Code: | Course Title: Biofertilizers | |

| Credits : 03 | Total number of hours |
|---|---|
| Max. Marks 25 + 75 | 45 Hrs |

| Unit | Content | Number of Hours |
|---|---|---|
| 1 | Biofertilizers: Introduction and types and importance of biofertilizers, History of biofertilizers production Classification of biofertilizers microorganisms used in biofertilizers production. | 05 |
| 2 | A study of growth characteristics of various microbes used in biofertilizers production. Nitrogen cycle in Nature. Process of nodule formation ,Role of Nif and Nod gene in Biological Nitrogen fixation, Enzyme nitrogenase and its component, Biochemistry of nitrogen fixation. *Rhizobium*–isolation, identification, mass multiplication, carrier-based inoculants. | 15 |
| 3 | A study of growth characteristics of Actinorrhizal symbiosis, *Azospirillum*: isolation and mass multiplication - carrier-based inoculant, associative effect of different microorganisms. | 15 |
| 4 | Growth characteristics of *Azotobacter*: classification, characteristics - crop response to Azotobacter inoculum, maintenance and mass multiplication. | 10 |

**Suggested readings**


1. Dubey, R.C., 2005 A Textbook of Biotechnology S.Chand & Co, New Delhi.
2. Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.
3. Sathe, T.V., 2004, Vermiculture and Organic Farming. Daya publishers.
4. Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New _Delhi.
5. Vayas, S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic _Farming Akta Prakashan, Nadiad
6. Kannaiyan, S., 2003, Biotechnology of Biofertilizers. CHIPS, Texas.
7. Rai, M.K., 2005, Hand book of Microbial Biofertilizers. The Haworth Press, Inc. NewYork


**Suggested Continuous Evaluation Methods**: Students can be evaluated on the basis of score obtained in a mid-term exam, together with the performance of other activities which can include short exams, in-class or online tests, home assignments, group discussions or oral presentations.

| Evaluation Method | Marks |
|---|---|
| Mid-term exam/in-class or on-line tests/home assignments/group discussions/oral presentations. | 15 |
| Overall performance throughout the semester, Discipline, participation in different activities& Attendance | 10 |

| Programme/Class: Certificate in Science | Year: First | Semester: Second |
|---|---|---|
| Paper- Theory Subject: Vocational/Skill Development Course | | |
| Course Code: | Course Title: Biofertilizers | |

| Credits : 03 | Total number of hours |
|---|---|
| Max. Marks 25 + 75 | 45 Hrs |

| Unit | Content | Number of Hours |
|---|---|---|
| 1 | General account of Cyanobacteria (blue green algae) | 05 |
| 2 | Azolla and Anabaena azolla association, nitrogen fixation, factors affecting growth, blue green algae and Azolla in rice cultivation. | 15 |
| 3 | Phosphate solubilizing microbes: Phosphate solubilizing microbes (anyone / consortia) - Isolation, characterization, mass inoculum production, field Application | 15 |
| 4 | Introduction to mycorrhiza. Mycorrhizal association, types of mycorrhizal association, Occurrence and distribution of mycorrhiza, growth on grass roots and observations for root colonization. Preparation of VA-mycorrhizal inoculum. | 10 |

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2. Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.
3. Sathe, T.V., 2004, Vermiculture and Organic Farming. Daya publishers.
4. Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New _Delhi.
5. Vayas, S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic _Farming Akta Prakashan, Nadiad
6. Kannaiyan, S., 2003, Biotechnology of Biofertilizers. CHIPS, Texas.
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| Evaluation Method | Marks |
|---|---|
| Mid-term exam/in-class or on-line tests/home assignments/group discussions/oral presentations. | 15 |
| Overall performance throughout the semester, Discipline, participation in different activities& Attendance | 10 |

| Programme/Class: Certificate in Science | Year: First | Semester: Third |
|---|---|---|
| Paper- Theory Subject: Vocational/Skill Development Course | | |
| Course Code: | Course Title: Biofertilizers | |

| Credits : 03 | Total number of hours |
|---|---|
| Max. Marks 25 + 75 | 45 Hrs |

| Unit | Content | Number of Hours |
|---|---|---|
| 1 | General account about soil health, Organic farming: History of organic farming, Need of organic farming, Benefits of organic farming, Green manuring and organic fertilizer, Social and market aspect of organic farming. | 10 |
| 2 | Role of microorganisms in decomposition of organic farm wastes, Different methods of Recycling of biodegradable municipal, agricultural and industrial waste. | 10 |
| 3 | Introduction to vermiculture, Vermicomposting: Types and methods of vermicomposting and its field applications ,Various methods of making bio-composts. | 10 |

| | | |
|---|---|---|
| 4 | Importance of *Trichoderma* spp., *Pseudomonas* spp. and *Bacillus* spp. as a biocontrol agents, Mechanism of disease control by these organisms bioagents , Effectiveness of bioagents against soil borne plant pathogens. | 15 |

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1. **Dubey, R.C., 2005 A Textbook of Biotechnology S.Chand & Co, New Delhi.**
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| Evaluation Method | Marks |
|---|---|
| Mid-term exam/in-class or on-line tests/home assignments/group discussions/oral presentations. | 15 |
| Overall performance throughout the semester, Discipline, participation in different activities& Attendance | 10 |

| Programme/Class: Certificate in Science | Year: First | Semester: Fourth |
|---|---|---|
| Paper- Theory Subject: Vocational/Skill Development Course | | |
| Course Code: | Course Title: Biofertilizers | |

| Credits : 03 | Total number of hours |
|---|---|
| Max. Marks 25 + 75 | 45 Hrs |

| Unit | Content | Number of Hours |
|---|---|---|
| 1 | Preparation of neem products and other botanicals for pest and disease control, Preparation of enriched farmyard manure and green pesticide, Methods of application of biopesticide | 10 |
| 2 | Quality analysis of biofertilizers: Formulation and self -life of biofertilizer Mass multiplication and packaging , Strategies of marking and Registration with CIB and organic farming institute. | 10 |
| 3 | Present scenario of biofertilizer and organic farming. Initiatives taken by the central and state governments, NGOs and other organization for application of biofertilizer and promotion of Organic farming in India. Relevance of organic farming and biofertilizer to Uttarakhand. | 10 |

| | | |
|---|---|---|
| 4 | Visit to organic cluster and biocontrol Labs to study the maintenance of biofertilizers/ bioinoculant cultures. Report preparation. Preparation of plan of biofertilizer production unit. | 15 |


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1. Dubey, R.C., 2005 A Textbook of Biotechnology S.Chand & Co, New Delhi.
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|---|---|
| Mid-term exam/in-class or on-line tests/home assignments/group discussions/oral presentations. | 15 |
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