।। सा विद्या या विमुक्तये ।।
स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड
"ज्ञानतीर्थ" परिसर, विष्णुपूरी, नांदेड - ४३१६०६ (महाराष्ट्र)
SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY NANDED
"Dnyanteerth", Vishnupuri, Nanded - 431606 Maharashtra State (INDIA)
Established on 17th September 1994 – Recognized by the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'A' Grade
ACADEMIC (1-BOARD OF STUDIES) SECTION
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विद्यापीठ अनुदान आयोगाने शैक्षणिक वर्ष २०२०–२१ पासून मान्यता दिलेल्या व्होकेशनल कोर्सेसचे (बी.व्होक पदवी, ॲडव्हॉस डिप्लोमा, डिप्लोमा व सर्टिफिकेट) अभ्यासक्रम शैक्षणिक वर्ष २०२०–२१ पासून लागू करणे बाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, विद्यापीठ अनुदान आयोगाने शैक्षणिक वर्ष २०२०–२१ पासून मान्यता दिलेल्या व्होकेशनल कोर्सेसच्या (बी. व्होक पदवी, ॲडव्हान्स डिप्लोमा, डिप्लोमा व सर्टिफिकेटस) अभ्यासक्रमांना मा विज्ञान व तंत्रज्ञान विद्याशाखेने **दिनांक ३१ मे २०२१ रोजीच्या बैठकीतील केलेल्या शिफारशीप्रमाणे व मा. विद्यापरिषदेच्या दिनांक १२ जून २०२१ रोजीच्या बैठकीतील विषय क्रमांक २६/५१–२०२१ च्या** ठरावानुसार खालील अभ्यासक्रमांस मान्यता देण्यात आली आहे.

1. B. Voc. IT/Hardware and Networking.
2. B. Voc Software Development.
3. B. Voc. Medical Laboratory Technology.
4. B. Voc. Horticulture and Post-Harvest Technology.
5. B. Voc. Herbal Medicine.
6. B. Voc. Commercial Aquaculture.
7. B. Voc. Food Processing Technology.
8. B. Voc. Skill Based Zoology.
9. B. Voc. Vocational Biotechnology.
10. B. Voc. Plant Tissue Culture Secretary.
11. Advance Diploma Radiological Physics.
12. Diploma – Computer Hardware.
13. Diploma – Computer Network Assistant.
14. Diploma – PGDMLT.
15. Diploma – Embedded System Design.
16. Diploma- Biofertilizer.
17. Diploma- Fisheries and Farm Management.
18. Diploma - Bee Keeping.

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या **www.srtmun.ac.in** या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी. ही विनंती.

जा.क्र.:शैक्षणिक–१/परिपत्रक/व्होकेशनल अभ्यासक्रम/N-२०२०–२१/६८

दिनांक : ०५.०७.२०२१

स्वाक्षरित
सहा.कुलसचिव
शैक्षणिक (१–अभ्यासमंडळ) विभाग

प्रत माहिती व पुढील कार्यवाहीस्तव :
१) मा. कुलसचिव यांचे कार्यालय, प्रस्तुत विद्यापीठ.
२) मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
३) प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
४) साहाय्यक कुलसचिव, पदव्युत्तर विभाग, प्रस्तुत विद्यापीठ.
५) उपकुलसचिव, पात्रता विभाग, प्रस्तुत विद्यापीठ.
६) सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

UGC Sanctioned Vocational Course

Syllabus for,

Certificate, Diploma, in Biofertilizer

(CBCS Pattern)

Semester I & II

Faculty: Science and Technology

(w.e.f. 2020-21)

Table: Indicating Eligibility, Duration, Total Credits.

Exit Points/ Awards	Eligibility	Normal Duration	Skill Component Credits	General Education Credits	Total Credits for Award	NSQF Level	Medium of instruction
Diploma	**12th** pass or **Diploma** in relevant field after 10th	Two semesters	36	24	60	5	English

Exit Points /Awards	Job Role
Diploma in Biofertilizer	Biofertilizer Analyst

About the Course:

Introduction of the Course:

Government of India, taking note of the requirement for skill development among students launched National Vocational Education Qualification Framework (NVEQF) which was later on assimilated into National Skills Qualifications Framework (NSQF). Various Sector Skill Councils (SSCs) are developing Qualification Packs (QPs), National Occupational Standards (NOSs) and assessment mechanisms in their respective domains, in alignment with the needs of the industry.

In view of this, the UGC implemented the scheme of Community Colleges from 2013-14 in pilot mode on the initiative of the MHRD. Thereafter, realizing the importance and the necessity for developing skills among students, and creating work ready manpower on large scale, the Commission decided to implement the scheme of Community Colleges as one of its independent schemes from the year 2014-15. The Commission also launched another scheme of B.Voc. Degree programme to expand the scope of vocational education and also to provide vertical mobility to the students admitted into Community Colleges for Diploma programmes to a degree programme in the Universities and Colleges. While these two schemes were being implemented, it was also realized that there is a need to give further push to vocational education on a even larger scale. Accordingly, 'Deen Dayal Upadhyay Centres for Knowledge Acquisition and Upgradation of Skilled Human Abilities and Livelihood (KAUSHAL)' was also incorporated. Since all these three provisions serve a common purpose, all these schemes are merged into a single scheme for providing skill based education under National Qualification Framework.

Type of Courses and Awards:

There will be full time credit-based modular programmes, wherein banking of credits for skill and general education components shall be permitted so as to enable multiple exit and entry. The multiple entry and exit enables the learner to seek employment after any level of Award and join back as and when feasible to upgrade qualifications / skill competencies either to move higher in the job profile or in the higher educational system. This will also provide the learner an opportunity for vertical mobility to second year of B.Voc degree programme after one year diploma and to third year of B.Voc degree programme after a two year advanced diploma. The students may further move to Masters and Research degree programmes mapped at NSQF Level 8 – 10.

Aims and Objectives:

The aims and objectives of the scheme of Vocational programme under NSQF are;

(i) To provide judicious mix of skills relating to a profession and appropriate content of general education.

(ii) To ensure that the students have adequate knowledge and skills, so that they are work ready at each exit point of the programme.

(iii) To provide flexibility to students by means of pre-defined entry and multiple exit points.

(iv) To integrate NSQF within the undergraduate level of higher education in order to enhance employability of the graduates and meet industry requirements.

(v) Such diploma graduates apart from meeting the needs of local and national industry are also expected to be equipped to become part of the global workforce.

(vi) To provide vertical mobility to students coming out of 10+2 with vocational subjects and Community Colleges.

The Objectives of the Diploma programme in Biofertilizer:

(i) To provide an updated education to the students at large in order to know the importance and scope of the discipline and to provide mobility to students from one university or state to other.

(ii) To develop a scientific attitude to make students open minded, critical and curious.

(iii) To develop an ability to work on their own and to make them fit for the society.

(iv) To develop skill in practical work, experiments, equipment and laboratory use along with collection and interpretation of materials and data.

(v) To make aware of natural resources and environment and the importance of conserving the same.

(vi) To develop ability for the application of the acquired knowledge in the relevant fields so as to make our country self-reliant and self-sufficient.

Outcome of the course:

(i) This program will train and orient the students in the field of Biofertilizers under the field of Agriculture.

(ii) This program will help the students for their career development.

(iii) This program shall train and orient the students for laboratory skills and serve as human resource for the industries and other organizations.

(iv) The programme also has a strong interdisciplinary component. Emphasis is given on the experimental learning through hands-on laboratory exercises, field trips and assignments.

(v) This skill oriented course will provide job opportunities and additional specific skills to the students for self-employability through the development of their own enterprises.

Swami Ramanand Teerth Marathwada University, Nanded
Syllabus structure for Diploma in Biofertilizer
(Under NSQF, Agriculture and Allied Faculties)

	Paper No.	Course Number	Course Title	Hr/Week	Type of Course	Credits	Marks		Total
							ESA	CIA	
Sem. I	**General Education Component**								
	Paper-I	BAAGE -111	Communication Skills	4	GE	4	75	25	100
	Paper-II	BAAGE -112	Basics of Computer	4	GE	4	75	25	100
	Paper-III	BAAGE -113	*Activity based on Paper-I & II	1	GE	1	-	25	25
	Skill Courses								
	Paper-IV	BIOFTH-111	Basics of Biofertilizer	4	CC	4	75	25	100
	Paper-V	BIOFTH-112	Biology of Biofertilizer	4	CC	4	75	25	100
	Paper-VI	BIOFTH-113	Life cycle of Microbes	4	CC	4	75	25	100
	Practical Skill Courses								
	Paper-VII	BIOFPR-111	Practical on Basics of Biofertilizer	3	PR	3	50	25	75
	Paper-VIII	BIOFPR-112	Practical on Biology of Biofertilizer	3	PR	3	50	25	75
	Paper-IX	BIOFPR-113	Practical on Life cycle of Microbes	3	PR	3	50	25	75
	Paper No.	**Course Number**	**Course Title**	**Hr/Week**	**Type of Course**	**Credits**	**Marks**		**Total**
							ESA	**CIA**	
Sem.II	**General Education Component**								
	Paper-X	BAAGE -124	Personality Development	4	GE	4	75	25	100
	Paper-XI	BAAGE -125	Environmental Study	4	GE	4	75	25	100
	Paper-XII	BAAGE -126	*Activity based on Paper-X & XI	1	GE	1	-	25	25
	Skill Courses								
	Paper-XIII	BIOFTH-121	Commercial Role of Microbes	4	CC	4	75	25	100
	Paper-XIV	BIOFTH-122	Agricultural Biotechnology	4	CC	4	75	25	100
	Paper-XV	BIOFTH-123	Quality control of Biofertilizers	4	CC	4	75	25	100
	Practical Skill Courses								
	Paper-XVI	BIOFPR-121	Practical on Commercial Role of Microbes	3	PR	3	50	25	75
	Paper-XVII	BIOFPR-122	Practical on Agricultural Biotechnology	3	PR	3	50	25	75
	Paper-XVIII	BIOFPR-123	Practical on Quality control of Biofertilizers	3	PR	3	50	25	75
					Total	**60**	**1050**	**450**	**1500**

Note:

1. The ESA part of practical and Industrial Project should be completely assessed and evaluated by external examiner.

2. The external examiner should be appointed for practical and industrial training ESA part.

3. * Sign denotes that internal assessment should be based on seminar/Interview skill/expected component of the course.

4. Student should submit the Report based on summer industrial training.

5. For VI semester students can opt Elective-I or Elective-II pattern.

6. Student should submit the certificate of three months industrial training from respective industries.

ESA: End Semester Assessment,

CIA: Continues Internal Assessment,

GE: General Education Component,

CC: Core Skill Courses,

PR: Practical Skill Courses,

CIA of 25 Marks (Theory): 15 Marks for college level internal test & 10 Marks for Assignment,

CIA of 25 Marks (Practical): 15 Marks for college level internal practical test & 10 Marks for Record Book and Field Note Book submission.

Swami Ramanand Teerth Marathwada University, Nanded

Diploma in Biofertilizer (Agriculture and Allied Faculties)

First Year (**Semester I**)

Paper-I: Communication Skills (BAAGE-111)

Maximum Marks: 100 **Credits: 4** **Periods: 45**

Unit I: Basic Grammar: (13 Periods)

Introduction, Grammar Word Classes (Open & Closed), Sentence – Kinds – Transformation, Phrase, Clause and its kinds, Simple, Complex & Compound sentences, (Only definitions & Structure), Tenses - Use of verbs in the Sentences

Unit II: Vocabulary: (10 Periods)

Morphology, Synonyms & Antonyms, One Word Substitution, Homophones & Homonyms

Unit III: Communication Skills: (10 Periods)

Definition & Types, Communication Cycle & Barriers, Principles for Effective Communication, Varieties in English (Indian, British & American).

Unit IV: Writing Skills: (12 Periods)

Letters (Formal & Informal), Report Writing (Scientific and Formal), Memorandum, Curriculum Vitae, Personal Employment Interview, Group Discussion. Phonetics: 44 sounds, consonants, vowels & Diphthongs, Transcription of words, Accent, Syllable cluster and Intonation.

Reference Books:

1. Developing of Communication Skills -Krishna Mohan & Meera Banerji

2. A Practical English Grammar A.J. Thomson –Oxford

3. Mastering English Grammar – S.H.Burton

4. Technical Communication- Raman Sharma- Oxford

5. Written Communication in English – Sarah Freeman Orient Longman Pvt. Ltd.

6. A Course in Phonetics & Spoken English -J.Sethi & P.V.Dhamija

7. Radiance-Tense

Swami Ramanand Teerth Marathwada University, Nanded

Diploma in Biofertilizer (Agriculture and Allied Faculties)

First Year (**Semester I**)

Paper-II Basics of Computer (BAAGE-112)

Maximum Marks: 100 **Credits: 4** **Periods-45**

Unit I: Basics of Computer: (10 Periods)

Introduction to computer, Definition and Types. Basic Applications of Computer; Components of Computer System, Central Processing Unit (CPU), VDU, Keyboard and Mouse, Other input/output Devices, Computer Memory, Concepts of Hardware and Software; Connecting keyboard, mouse, monitor and printer to CPU and checking power supply.

Unit II: Computer Operation: (13 Periods)

Operating Computer using GUI Based Operating System: What is an Operating System; Basics of Popular Operating Systems; The User Interface, Using Mouse; Using right Button of the Mouse and Moving Icons on the screen, Use of Common Icons, Status Bar, Using Menu and Menu-selection, Running an Application, Viewing of File, Folders and Directories, Creating and Renaming of files and folders, Opening and closing of different Windows;

Unit III: MS-Office: (10 Periods)

Introduction to MS-Word: Word Processing Basics; Opening and Closing of documents; Text creation and Manipulation; Formatting of text; Table handling; Spell check, language setting and thesaurus; Printing of word document. MS- Excel, Power Point. Internet concept & definition, WWW, URL, http, Browsers, Search engines etc.

Unit IV: Computer Networking: (12 Periods)

Basic of Computer networks; LAN, MAN, WAN; Concept of Internet; Applications of Internet. Communications and collaboration: Basics of electronic mail; Getting an email account; Sending and receiving emails; Accessing sent emails; Using Emails; Document collaboration; Instant Messaging; Netiquettes.

Reference Books:

1. Introduction of Computer Science- Pcushman & R. Mata Toledo, McGraw Hill
2. Computer fundamentals – P.K. Sinha – BPB New Delhi.
3. Microsoft Office – 2000Complete – BPB Practicals

Swami Ramanand Teerth Marathwada University, Nanded

Diploma in Biofertilizer (Agriculture and Allied Faculties)

First Year (**Semester I**)

Paper-IV: Basics of Biofertilizer (BIOFTH-111)

Maximum Marks: 100 **Credits: 4** **Periods: 45**

Unit I Introduction to Biofertilizers (10 Period)

Introduction and general account about the microbes used as biofertilizer, Rhizobium – isolation, identification, mass multiplication, carrier-based inoculants, Actinorhizal symbiosis.

Unit II Mycorrhizal Association (12 Period)

Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants.

Unit III Types of Biofertilizer (12 Period)

Biofertilizer Types, Commercial history, Introduction to important Biofertilizers such as *Rhizobium*, *Azotobacter*, *Azospirillum*, Cyanobacteria, *Azolla*, *Beijerinckia*, PSM, AM fungi, Silicate solubilizing bacteria (SSB), Plant Growth Promoting Rhizobacteria (PGPR) and mass production.

Unit IV Nutrition in Plants (11 Period)

Major and Minor elements, source, deficiency symptoms and their role. Foliar nutrition, hydroponic technique. Mineral salt absorption, active and passive absorption of nutrients in plants.

Swami Ramanand Teerth Marathwada University, Nanded

Diploma in Biofertilizer (Agriculture and Allied Faculties)

First Year (**Semester I**)

Paper-V: Biology of Biofertilizer (BIOFTH-112)

Maximum Marks: 100 **Credits: 4** **Periods: 45**

Unit I Fungi as Biofertilizer (12 Period)

Plant growth stimulating fungi, Trichoderma, Mycorrhizal fungi; Ectomycorrhiza e.g. *Pisolithus tinctonus* and Arbuscular mycorrhizae e.g. *Glomus intraradices*, mutualistic associations with plants, enzymatic producing fungi for compost production and Phosphate solubilizing fungi.

Unit II AM Biofertilizer (Arbuscular Mycorrhizal Fungi) (11 Period)

Characteristics and types of association, production methods and application of AM biofertilizer.

Unit III Algal Biofertilizer (11 Period)

Introduction and types of algal Biofertilizer, application of algae in agriculture, Commercial role of algae, algae culture and algal food.

Unit IV PSB Biofertilizer (Phosphate solubilizing Bacteria) (11 Period)

Mechanism of phosphate solubilization, production methods and application of PSB biofertilizer.

Swami Ramanand Teerth Marathwada University, Nanded

Diploma in Biofertilizer (Agriculture and Allied Faculties)

First Year (**Semester I**)

Paper-VI: Life cycle of Microbes (BIOFTH-113)

Maximum Marks: 100 **Credits: 4** **Periods: 45**

Unit I *Rhizobium* Biofertilizer (12 Period)

Characteristics, Host-*Rhizobium* interactions, N2-fixation in root nodules, Production, Methods of application.

Unit II *Azotobacter* Biofertilizer (11 Period)

Characteristics, N2-fixation process, Production, Methods of application. Crop interaction. Crop maintenance.

Unit III *Azospirillum* Biofertilizer (11 Period)

Characteristics, Association with plants, Production, Methods of application. Crop interaction. Crop maintenance.

Unit IV *Azolla* & BGA Bio fertilizers (11 Period)

Azolla Characteristics, Production, Methods of application. BGA Characteristics, N2-fixation process, Production, Methods of application.

Swami Ramanand Teerth Marathwada University, Nanded

Diploma in Biofertilizer (Agriculture and Allied Faculties)

First Year (**Semester I**)

Paper-VII: Practical on Basics of Biofertilizer (BIOFPR-111)

Maximum Marks: 75 **Credits: 3** **Periods: 30**

List of Practical:

1. Isolation of Phosphate solubilizing micro-organisms from rhizosphere.
2. Isolation of Rhizobium from root nodules of leguminous crop.
3. Isolation and purification of Azotobacter from soil.
4. Isolation and purification of *Azospirillum* from soil.
5. Study of isolation of Cyanobacteria
6. Isolation and purification of Beijerinckia form soil.
7. Isolation of Azospirillum.
8. Isolation Blue Green Algae from soil.
9. VAM – isolation and inoculum production of VAM.
10. Study of plant growth promoting Rhizobacteria (PGPR) and its mass production.
11. To study the mineral deficiency symptoms in at least four locally available plants

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Swami Ramanand Teerth Marathwada University, Nanded

Diploma in Biofertilizer (Agriculture and Allied Faculties)

First Year (**Semester I**)

Paper-VIII: Practical on Biology of Biofertilizer (BIOFPR-112)

Maximum Marks: 75 **Credits: 3** **Periods: 30**

List of Practical:

1. Isolation & preparation of bacterial fertilizer *Azotobacter*.
2. Isolation & preparation of bacterial fertilizer *Azospirillum.*
2. Isolation and preparation of symbiotic biofertilizer *Rhizobium.*
3. Isolation of Phosphate solubilizing bacteria from soil.
4. Isolation and identification of AM fungi from soil and preparation of biofertilizer.
5. Determination of heterocyst frequency of blue green bacteria.
6. Evaluation of the phosphate-solubilizing capability of microorganism.
7. Collection and preservation of root nodules in field trips.
8. Study of algal Biofertilizer.
9. Enzymatic production of fungi for compost formation.
10. Study of different types of endophytic fungi.

Swami Ramanand Teerth Marathwada University, Nanded

Diploma in Biofertilizer (Agriculture and Allied Faculties)

First Year (**Semester I**)

Paper-IX: Practical on Life cycle of Microbes (BIOFPR-113)

Maximum Marks: 75 **Credits: 3** **Periods: 30**

List of Practical:

1. Isolation of organic matter decomposing microorganisms.
2. Mass multiplication of *Rhizobium* inoculum.
3. Mass multiplication of *Azotobacter* inoculum.
4. Mass multiplication of *Azospirillum* inoculum.
5. Production and application of blue green algae.
6. Production of Azolla biofertilizers.
7. Isolation of arbuscular mycorrhizal spores from rhizospheric soil.
8. Study of Methods of application of BGA.
9. Comparative study of Biofertilizer applied crop for yield.
10. Study of different host for *Rhizobium.*

Swami Ramanand Teerth Marathwada University, Nanded

Diploma in Biofertilizer (Agriculture and Allied Faculties)

First Year (**Semester II**)

Paper-X: Personality Development (BAAGE-124)

Maximum Marks: 100 **Credits: 4** **Periods: 45**

UNIT-I: Personality Development: (Periods: 11)

Introduction to personality development: The concept personality- Dimensions of theories of Freud & Erickson- personality – significant of personality development. The concept of success and failure: What is success? - Hurdles in achieving success - Overcoming hurdles - Factors responsible for success, What is failure - Causes of failure. SWOT analyses.

UNIT-II: Attitude & motivation: (Periods:11)

Attitude - Concept - Significance - Factors affecting attitudes - Positive attitude - Advantages – Negative attitude - Disadvantages - Ways to develop positive attitude - Difference between personalities having positive and negative attitude. Concept of motivation - Significance - Internal and external motives - Importance of self-motivation- Factors leading to de-motivation

UNIT-III: Interpersonal Relationship: (Periods: 11)

Term self-esteem - Symptoms - Advantages - Do's and Don’ts to develop positive self-esteem – Low self-esteem - Symptoms - Personality having low self-esteem - Positive and negative self-esteem. Interpersonal Relationships – Defining the difference between aggressive, submissive and assertive behaviors - Lateral thinking.

UNIT-IV: Overall personality development: (Periods: 12)

Other aspects of personality development: Body language, Problem-solving, Conflict and Stress Management, Decision making skills, Leadership and qualities of a successful leader. Character building, Team-work, Time management, Work ethics, Good manners and etiquette. Employability quotient: Resume building, The art of participating in Group Discussion. Facing the Personal (HR & Technical) Interview.

Refrence Books:

1. “Personality Development and Soft Skills” by Barun Mitra
2. The Only Skill That Matters by Jonathan A. Levi

3. “Personality Development” by Swami Vivekananda

4. “Personality Development for Students” by Dr Vijay Agrawal

5. Soft Skills Personality Development for Life Success- 2nd Edition by Prashant Sharma

Swami Ramanand Teerth Marathwada University, Nanded

Diploma in Biofertilizer (Agriculture and Allied Faculties)

First Year (**Semester II**)

Paper-XI: Environmental Study (BAAGE-125)

Maximum Marks: 100 **Credits: 4** **Periods: 45**

Unit-I: Ecosystems: (Periods: 11)

Introduction, Concept of an ecosystem. Structure and function of an ecosystem. Energy flow in the ecosystem. Food chains, food webs. Ecological pyramids: Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem b. Aquatic ecosystems (ponds)

Unit-II: Biodiversity: (Periods: 11)

Introduction, Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. India as a mega diversity nation. biodiversity Hot-spots of India. Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Unit-III: Environmental Biology: (Periods: 12)

Environmental Pollution; Introduction, Definition, Causes, effects and control measures of: a. Air pollution b. Water pollution c. Soil pollution d. Noise pollution f. Thermal pollution g. nuclear hazards. Disaster Management; Natural disaster- Earthquake, Tsunami, Cyclone, Tornedo, Chemical Disaster- Bhopal Gas Tragedy, Nuclear Disaster- Chernobil.

Unit-IV: Natural Resources: (Periods: 11)

Renewable and Nonrenewable Resources; Solar Energy, Wind Energy. Forest Resources, Metal Mines, Crude Oil Mines. Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people. Environmental ethics. Population growth, Population explosion.

REFERENCES:

1. Agarwal, K.C.2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.

2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd. Ahmedabad — 380 013, India, Email: mapin@icenet.net (R)

3. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill lnc.480p

4. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)

5. Cunningham, W. P. Cooper, T. H. Gorhani, E & Hepworth, M.T.2001. Environmental Encyclopedia, Jaico Publ. House. Mumbai, 1196p

6. Dc A.K., Environmental Chemistry, Wiley Eastern Ltd.

7. Down to Earth, Centre for Science and Environment(R)

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Swami Ramanand Teerth Marathwada University, Nanded

Diploma in Biofertilizer (Agriculture and Allied Faculties)

First Year (**Semester II**)

Paper-XIII: Commercial Role of Microbes (BIOFTH-121)

Maximum Marks: 100 **Credits: 4** **Periods: 45**

Unit I Azospirillum (10 Period)

Azospirillum: isolation and mass multiplication – carrier based inoculant, associative effect of different microorganisms.

Unit II Azotobacter (10 Period)

Azotobacter: classification, characteristics – crop response to Azotobacter inoculum, maintenance and mass multiplication.

Unit III Cyanobacteria (12 Period)

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

Unit IV Organic Farming (13 Period)

Organic farming – Green manuring and organic fertilizers, recycling of biodegradable municipal, agricultural and Industrial wastes – bio-compost making methods, types and method of vermicomposting – field Application.

Swami Ramanand Teerth Marathwada University, Nanded

Diploma in Biofertilizer (Agriculture and Allied Faculties)

First Year (**Semester II**)

Paper-XIV: Agricultural Biotechnology (BIOFTH-122)

Maximum Marks: 100 **Credits: 4** **Periods: 45**

Unit I Maintenance and Preparation of Biofertilizer (11 Period)

Culturing of microbes, preparation of inoculums, processing and preparation of carrier material, mass production, packaging and storage, Concept and its need in organic farming, treatment.

Unit II Microbial interactions in soil (11 Period)

Soil humus, Nitrogen Fixation - Physiology of nitrogen cycle. Assimilatory and dissimilatory nitrate reduction, biological nitrogen fixation. Nitrogen fixers and mechanism of nitrogen fixation, properties of nitrogenase, and ammonia assimilation.

Unit III Genetics of nitrogen fixation (10 Period)

Genetics of nitrogen fixation and regulation of nitrogenase activity and synthesis. Alternate nitrogenase.

Unit IV Microbial interaction (13 Period)

Microbe - Microbe Interactions - Mutualism, Synergism, Commensalism, Competition, Amensalism, Parasitism, Predation, Biocontrol agents.

Microbe - Plant Interactions - Roots, Aerial Plant surfaces, Biological Nitrogen fixation (symbiotic/nonsymbiotic - biofertilizers).

Microbe–Animal Interactions - Role of Microbes in Ruminants, Nematophagus fungi, Luminescent bacteria as symbiont.

Swami Ramanand Teerth Marathwada University, Nanded

Diploma in Biofertilizer (Agriculture and Allied Faculties)

First Year (**Semester II**)

Paper-XV: Quality control of Biofertilizers (BIOFTH-123)

Maximum Marks: 100 **Credits: 4** **Periods: 45**

Unit I Quality Standards (12 Period)

Quality Standards of Biofertilizers, Introduction to FCO (Fertilizer Control Order), specifications for bio fertilizers, Sampling procedure, Methods of analysis, Standards of biofertilizers,

Unit II Biofertilizer Plant (11 Period)

Introduction and basics of Biofertilizer plant establishment, water, power, machinery supply, use of standard media, nutrients, commercial production and packaging.

Unit III Biofertilizer technology (11 Period)

Basics about biofertilizer technology, Biostability of Biofertilizers. Constraints in Biofertilizer technology, Cost and availability of Biofertilizers, Benefits and Characteristics of Liquid biofertilizers.

Unit IV Quality Control (11 Period)

Biofertilizers - Storage, shelf life, quality control and marketing. Biosafety, Piracy, Expiry of products, Recycling of waste and expired products.

Swami Ramanand Teerth Marathwada University, Nanded

Diploma in Biofertilizer (Agriculture and Allied Faculties)

First Year (**Semester II**)

Paper-XVI: Practical on Commercial Role of Microbes (BIOFPR-121)

Maximum Marks: 75 **Credits: 3** **Periods: 30**

List of Practical:

1. Preparation of biofertilizer carrier materials; **(Four Practical)**
   (a) Preparation of materials,
   (b) Irradiation (sterilization),
   (c) Confirmation of sterilization effect,
   (d) Inoculation of microorganisms to carrier.
2. Study of associative effect of different microorganisms with *Azospirillum.*
3. Study of crop response to Azotobacter inoculum on field.
4. Study of Azolla and Anabaena azollae association on field.
5. Study of methods for preparation of Green manure.
6. Study of bio-compost making methods.
7. Study of vermicompost preparation and its field Application.

Swami Ramanand Teerth Marathwada University, Nanded

Diploma in Biofertilizer (Agriculture and Allied Faculties)

First Year (**Semester II**)

Paper-XVII: Practical on Agricultural Biotechnology (BIOFPR-122)

Maximum Marks: 75 **Credits: 3** **Periods: 30**

List of Practical:

1. Culturing of microbes and preparation of inoculums.
2. Study of packaging and storage of microbial culture.
3. Estimation of total nitrogen by Kjeldahl digestion method.
4. Determination of Nitrogen concentration by indophenol method.
5. Determination of total nutrient content by spectrophotometric method.
6. Estimation of Nitrogenase activity by acetylene reduction assay.
7. Colorimetric estimation of amino-N and nitrate-N.
8. Comparative study of different nitrogen fertilizers.
9. Identification of Nitrogen deficiency in locally available crops and its symptomology.
10. Field study of Nitrogen fertilizer Application.

Swami Ramanand Teerth Marathwada University, Nanded

Diploma in Biofertilizer (Agriculture and Allied Faculties)

First Year (**Semester II**)

Paper-XVIII: Practical on Quality control of Biofertilizers (BIOFPR-123)

Maximum Marks: 75 **Credits: 3** **Periods: 30**

List of Practical:

1. Quality control of microbial inoculants in Laboratory.
2. Study of Methods of application of biofertilizers.
3. Study of different sampling methods.
4. Study of Standards for commercial production of biofertilizers.
5. Quality control of biofertilizers for packaging and storage.
6. Study of methods for recycling of waste and expired products.
7. Preparation of Model Biofertilizer industry and study of water, power, machinery supply.
8. Study of biostability measures of Biofertilizer industry.
9. Survey of commercial biofertilizer products available in local market.
10. Visit to Commercial Biofertilizer Industry and preparation of visit report.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based Credit System (CBCS)

(Semester Pattern)

Theory Examination

Question Paper Pattern

Maximum Marks: 75 **Time: 3.00 Hrs**

Q1. Long Answer Type Question ……..(15 Marks).

OR

(a) Short Answer Type Question ……(8 Marks)

(b) Short Answer Type Question ……(7 Marks).

Q2. Long Answer Type Question ……..(15 Marks).

OR

(a) Short Answer Type Question ……(8 Marks)

(b) Short Answer Type Question ……(7 Marks).

Q3. Long Answer Type Question ……..(15 Marks).

OR

(a) Short Answer Type Question ……(8 Marks)

(b) Short Answer Type Question ……(7 Marks).

Q4. Long Answer Type Question ……..(15 Marks).

OR

(a) Short Answer Type Question ……(8 Marks)

(b) Short Answer Type Question ……(7 Marks).

Q5. Write a short note on (**Any three** of following); (15 Marks)

(a) ……..(5 Marks)

(b) ……..(5 Marks)

(c) ……..(5 Marks)

(d) ……..(5 Marks)

(e) ……..(5 Marks).

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SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based Credit System (CBCS)

(Semester Pattern)

Practical Examination

Question Paper Pattern

Maximum Marks: 50 **Time: 4.00 Hrs**

Q1. Perform the Major Experiment ……..(20 Marks).

Q2. (a) Perform the Minor Experiment ……(10 Marks).

(b) Describe procedure and working of the Minor Experiment ……(10 Marks).

Q3. (a) Viva -voce ..……(5 Marks).

(b) Submission of Field Collection and Samplings during Field Visits and Excursions. ..……(5 Marks).

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Suggested Readings on Biofertilizers:

1. Somani, L.L., S.C. Bhandari, K.K. Vyas and S.N. Saxena. 1990. Biofertilizers, Scientific Publishers - Jodhpur.
2. Bagyaraj, D.J. and A. Manjunath. 1990. Mycorrhizal symbiosis and plant growth, Univ. of Agricultural Sciences, Bangalore, India.
3. Krieg N.R. and J.G. Holt, 1984 Bergy's manual of systematic bacteriology, Williams and Witkins, Baltimore, U.S.A.
4. Purohit, S.S., P.R. Kothari and S.K. Mathur, 1993. Basic and Agricultural Biotechnology, Agro Botanical Pub. India.
5. Rangaswamy G. and D.J. Bhagyaraj 1988 Agricultural Microbiology, Oxford and IBH Publication Co. New Delhi.
6. Subba Rao, Soil microorganisms - Oxford and IBH Publication Co. New Delhi.
7. Subba Rao, Advances in Agril. Microbiology, Oxford and IBH Publication Co, New Delhi.
8. Subba Rao, N. S. 1988. Biological nitrogen fixation: recent developments, Mohan Primlani for Oxford and IBH Pub. Co. (P) Ltd., India.
9. Subba Rao, N.S., G.S. Venkataraman and S. Kannaiyan 1993. Biological nitrogen Fixation, ICAR Pub., New Delhi.