

**BHARATHIDASAN UNIVERSITY, TIRUCHIRAPALLI – 620 024**

**UGC SPONSORED ADD-ON COURSE**

**ADVANCED DIPLOMA IN BIOFERTILIZERS & VERMICULTURE**

**REGULATIONS**

**1. ELIGIBILITY**

Regular candidates shall be permitted to study the Advanced Diploma courses concurrently when they do their UG courses. The classes may be conducted either during week days after class hours or during weekly holidays.

**2. SCHEME OF EXAMINATIONS**

Semester	Paper	Hrs/ Week	Exam Hours	Total
II	Paper I – Bacterial Biofertilizers	6	3	100
III	Paper II – Cyanobacteria and Azolla as Biofertilizers	6	3	100
	Practical I – Bacterial Biofertilizers	3	3	100
	Practical II – Cyanobacteria and Azolla as Biofertilizers	3	3	100
IV	Paper III – Vermiculture	6	3	100
V	Paper IV – Mycorrhizal Biofertilizers	6	3	100
	Practical III – Vermiculture	3	3	100
	Practical Paper IV – Micorrhizal Biofertilizers	3	3	100
VI	Project Work and Viva Voce Project Work 150 marks, Viva 50 marks	-	-	200

### **3. PASSING MINIMUM**

A candidate shall be declared to have passed in each paper if he/she secures not less than 40% of the prescribed maximum marks. He/she shall be declared to have passed the whole examination and qualified for the Advanced Diploma if he/she passes in all the paper.

### **4. CLASSIFICATION OF SUCCESSFUL CANDIDATES :**

Those who secure 60% or above the maximum marks shall be declared to have passed in I class; those who secure with 50% or above but below 60% shall be declared to have passed in II class. All other successful candidates shall be declared to have passed the examination in the III class.

### **5. AWARD OF ADVANCED DIPLOMA**

A candidate shall be eligible for the award of the Advanced Diploma if he she has passed all the examinations prescribed thereof.

### **6. REVISION OF REGULATIONS AND CURRICULUM**

The University may from time to time revise, amend and change the regulations and the curriculum if found necessary.

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## Paper – I: Bacterial biofertilizers

1. Brief history of bacteria as biofertilizers.
2. Symbiotic nitrogen fixation: Leguminous crop symbiosis--isolation, identification, mass inoculum production and field application. Non-leguminous crop symbiosis-*Frankia*- isolation, identification, mass inoculum production and field application.
3. Free living non-symbiotic nitrogen fixation: isolation, identification, mass inoculum production and field application.
4. *Azotobacter*- isolation, identification, mass inoculum production and field application.  
*Acetobacter*- isolation, identification, mass inoculum production and field application.
5. Phosphate solubilizing bacteria- *Bacillus megaterium*- isolation, identification, mass inoculum production and field application.

## Practical I

1. Cleaning of glasswares
2. Sterilization methods
3. Preparation of media, broth, selective media for various biofertilizer organisms.
4. Isolation of Azotobacter from soil
5. Isolation of Rhizobium from root nodules
6. Isolation of Azospirillum from soil
7. Isolation of Phosphobacteria from soil
8. Mass multiplication method-bio fertilizer manufacturing

Course	V	Title	Semester	IV
Course Code		Principles of Web Technology	Hours	60
			Credits	4

**Objectives:** To imbibe the necessary knowledge of the tools useful for creating dynamic website. Also to know the tools involving client server technology. At the end of the programme the learners could be able to design a simple interactive website.

**Unit-I:**

HTML: Basic HTML, The Document body, Text, Hyperlinks, Adding more formatting, Lists, Tables, Using colors and images, Images, Multimedia objects, Frames, Forms-towards interactivity, Cascading Style Sheets: Introduction, Using styles: Simple examples, Defining your own styles, Properties and values in styles.

**Unit-II:**

**Client Side Scripting :** Javascript—The basics, Variables, String manipulation, Mathematical functions, Statements, Operators, Arrays, Functions- Data and objects in java script, Regular expressions, Exception Handling, Built in objects, Events. Dynamic HTML with Java Script: Data validation, Opening a new window, Messages and Confirmations, The status bar, Writing to a different frame, Rollover buttons, Moving images, Multiple pages in a single download, A text-only menu system, Floating logos.

**Unit-III:**

**Server Side Scripting: PHP:** evolution of PHP – structure and syntax of PHP and integrating the same with HTML – comments – variables – datatypes – operators – control structures – passing information between pages – Strings – Arrays and Functions

**Unit-IV:**

**MySQL Databases:** SQL tutorial(DDL, DML, DCL) - MySQL introduction – datatypes in MySQL – Pattern Matching – GroupBy – IS NULL – DISTINCT Optimization – Max and Min function – Using auto increment

**Unit-V:**

**Integration of Apache, MySQL, PHP to design dynamic web pages:** MySQL functions in PHP – Connecting and disconnecting from MySQL – Using tables – form design – editing the database – Validation – Handling and avoiding errors.

**Text Books:**

1. Timothy Boronczyk, Michael, Elizabeth Naramore, Jason Gerner, Yann Le Scouarnec, Jeremy Stolz,, Michael K. Glass "**Beginning PHP6, Apache, MySQL® Web Development**", Wiley Publishing, 2009 edition. **ISBN-13:** 978-8126521227.
2. Chris Bates, "Web Programming Building Internet Applications", Second Edition, Wiley (2007)

**Reference Books:**

1. Robin Nixon, "**Learning PHP, MySQL & JavaScript With jQuery, CSS & HTML5**" O'Reilly Media, Fourth edition, December 2014, ISBN:978-1-491-91866-1.
2. David R. Brooks, "**An Introduction to HTML and JavaScript for Scientists and Engineers**", Springer-Verlag London Limited 2007, ISBN-13: 978-1-84628-656-8
3. Michael K Glass, Yann Le Scouarnec, Elizabeth Naramore, Gary Mailer, Jeremy Stolz, Jason Gerner, "**Begining PHP, Apache, MySQL Web Development**", Wiley dreamtech press, 2004 edition. ISBN: 9780764557446

### Paper-III Cyanobacteria and Azolla as Biofertilizers

1. General account of Cyanobacteria-Classification, identification, morphology, anatomy and reproductive characters.
2. Ecology-Cyanobacteria in different habitats, Nitrogen fixation, Association between Cyanobacteria and fungi; Cyanobacteria-liverworts; Cyanobacteria-ferns; Cyanobacteria-higher plants.
3. Cyanobacteria isolation from paddy fields, identification, mass multiplication, field application and immobilization.
4. *Azolla*-morphology, anatomy, reproductive characters and classification.
5. *Azolla*-isolation and mass multiplication, role in paddy cultivation.

## Practical II

1. Microscope – parts - uses
2. Cyanobacteria – heterocystous and non heterocystous forms
3. Collection of cyanobacterial forms
4. Preparation of cyanobacterial culture medium (BGM)
5. Isolation, purification and preservation methods
6. Mass multiplication methods
7. Collection and examination of Azolla from natural habitats for cyanobacterial association. Multiplication in ponds/lakes

ADVANCED DIPLOMA IN BIOFERTILIZERS AND VERMICULTURE

PAPER - ~~IV~~ VERMICULTURE

UNIT I

Diversity and distribution of earthworms in India. Ecological classification of earthworms.

- i. Epigeic earthworms
- ii. Anecic earthworms and
- iii. Endogeic earthworms

Various species involved in vermiculture. Advantages of vermiculture.

UNIT - II

General body structures of earthworms. Morphology - Coelom - Body wall - Locomotion - Excretion - Respiration - Digestive, Circulatory, Nervous and Reproductive systems - Cocoon formation.

UNIT - III

Food and feeding of earthworms.

- i. Humus feeders
- ii. Humus formers
- iii. Saprophages
- iv. Detritivores
- v. Geophages

Role of earthworms in sustainable agriculture - Organic farming - Earthworm activities - soil fertility and texture - soil aeration - water percolation - Decomposition and moisture.

UNIT - IV

Vermiculture Practices

Organic wastes: Municipal, Agricultural and other wastes - Animal dung - Requirements/Materials required for vermiculture and vermivash - preparation of predigested materials - selection of suitable species - optimal culture conditions required -

Protection from sunlight, rain, predators and parasites -Methods of harvesting, packing and storage, Nutrient composition of vermicompost. Methods of application to crop plants. Advantages of using vermicompost and vermiwash their benefits to environment.

#### UNIT - V

Vermicomposting at home - Vermicomposting on the farm - small scale and large scale - case studies - saleable products of vermiculture - Economic returns - Self employment venture: Prospects of vermiculture as a self employment venture - Preparation of a proposal (Lay out for vermicomposting yard and vermiwash unit and budget) for getting financial assistance from banks.

#### References:

1. Gupta, P.K. 2005. Vermicomposting for sustainable agriculture (SE) Agrobios [India], Jodhpur, India 210p.
2. Bhatnagar, R.K. and Palta, R.K. 1996. Earthworm vermiculture and vermicomposting. Kalyani Publishing. Luthiana. India. 106p.
3. Ismail, S.A. 2005. The Earthworm Book. Other India Press. Goa.
4. Talashilkar, S.C. and Dosani, A.A.K. 2005. Earthworms in agriculture. Agrobios (India), Jodhpur.
5. Ranganathan, L.S. 2006. Vermibiotechnology. From Soil Health to Human Health. Agrobios (India), Jodhpur.

## PRACTICAL - III

### VERMICULTURE

1. Collection of raw materials (organic wastes and animal dung)
2. Preparation of predigested food for earthworms
3. Identification of various species of indigenous and exotic forms of earthworms used in vermiculture
4. Introducing earthworms into the pits
5. Harvesting and packing
6. Elemental composition of vermicompost

### VERMIWASH

1. Assembly of vermiwash unit
2. Production of vermiwash
3. Harvesting and packing

### SPOTTERS

- A. Penial setae
- B. Body setae
- C. Cocoon of earthworms
- D. Vermicompost
- E. Vermiwash
- F. Animal dung
- G. Organic wastes
- H. Vermiwash unit
- I. Various species of earthworms used in vermiculture

## **PAPER – IV: MYCORRHIZAL BIOFERTILIZERS**

**UNIT I:** General account of mycorrhizal fungi- morphology, anatomy, reproductive characters and classification

**UNIT II:** Ecology and distribution of mycorrhizal fungi – occurrence I different habitats – tropical temperate forests, grasslands and dunes, saline soils, and agricultural fields.

**UNIT III:** Methods of isolation of VAM and ectomycorrhizal fungi

**UNIT IV:** Identification of VAM and ectomycorrhizal fungi

**UNIT V:** Mass inoculum production of VAM and ectomycorrhizal fungi, field application and crop response.