

## GENERIC ELECTIVE (BOT-GE-3)

### 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>Protected Agriculture – Hydroponics and Organic Cultivation</b> <b>BOT-GE-3</b>	4	2	0	2	-	<b>None</b>

### Learning Objectives

The Learning Objectives of this course are as follows:

- To provide knowledge and expertise of various aspects of hydroponics, aquaponics and organic cultivation to students.
- To make students economically self-reliant by growing and marketing organic herbs, vegetables, microgreens and fruits.

### Learning outcomes

The Learning Outcomes of this course are as follows:

- Students will develop a thorough understanding of the concepts of Hydroponics, Aquaponics and Organic farming.
- Students will be trained in establishing hydroponic facility.
- Students will learn the development of various organic products such as biopesticides, biofertilizers and bio-organic growth promoters.
- Students will understand various government policies in marketing of hydroponic and organic produce.
- Students will understand Good Agricultural Practices associated with protected agriculture.

## **SYLLABUS OF BOT-GE-3**

### **Unit 1: Introduction to Protected Agriculture**

**Week: 01**

Types of Protected Agriculture (hydroponics, aquaponics and organic farming), definition, history, terminology, importance and advantages over traditional agriculture, limitations and challenges.

### **Unit 2: Plant Growth Requirements and Media formulations**

**Weeks: 2.5**

Physical parameters - light (quality and quantity) artificial light, light balancers; pH, conductivity, salinity (Dissolved Oxygen-DO, Total Dissolved Solid - TDS) and temperature; Chemical parameters- mineral nutrient requirements, deficiencies, toxicities, growth regulators (auxins, gibberellins, cytokinins and abscisic acids); Growth media- types, properties, uses, nutrient formulae, preparation of solutions, solid Media and nutrient film.

### **Unit 3: Hydroponic growing systems**

**Weeks: 3.5**

Basic concepts and designs (closed and open systems techniques Nutrient Film Technique (NFT), Deep Water Culture (DWC), Dutch Bucket and other small-scale systems), systems layout. Strengths and weaknesses of various systems, site considerations, componentry, nutrient delivery, pumping

### **Unit 4: Hydroponics associated pest and diseases**

**Weeks: 03**

Hydroponics associated pest - mites, thrips, whiteflies, leaf miners; Identification and management of diseases -bacterial, fungal and viral diseases; safety practices (Good Agricultural Practices (GAP) and Integrated Pest Management (IPM)).

### **Unit 5: Organic farming and its management**

**Weeks: 03**

Organic farming and associated management practices (nutritional requirements, pest, diseases, weeds); use of biofertilizers, biopesticides, bioherbicides, biocontrol agents (plant growth promoting rhizobacteria (PGPR), pheromone trapping, *Trichoderma*, *Pseudomonas*, neem oil, garlic etc.) in management.

**Unit 6: Marketing and Policies****Weeks: 02**

Marketing of the produce and government institutes and policies related to protected farming (hydroponics and organic farming).

**Practicals:**

1. Study of various instruments used in hydroponics. **(Week: 01)**
2. Preparation of growth media for hydroponics. **(Week: 01)**
3. Estimation of NPK, DO, TDS, pH of growing media. **(Week: 01)**
4. Demonstration of different irrigation techniques in hydroponics. **(Week: 01)**
5. Demonstration of construction of a sustainable hydroponic unit. **(Weeks: 02)**
6. Perform rapid tests for estimation of NPK in different soil samples (samples from at least three different sites). **(Week: 01)**
7. Bulk density and porosity of soilless media e.g. coco-peat, perlite, vermiculite, expanded clay, rockwool (any two media). **(Week: 01)**
8. Demonstration of growing a leafy vegetable/fruity vegetable/ medicinal herb/aromatic plant in Hydroponics solution. **(Weeks: 02)**
9. Study of traditional organic inputs and formulation of biofertilizer. **(Weeks: 02)**
10. Preparation of biopesticides, plant health promoters like *Panchgavya*, *Beejamrut* etc. **(Week: 02)**
11. Field visit to organic farm/hydroponic farm and submission of visit report. **(Week: 01)**

**Essential/recommended readings:**

1. Schwarz, M. (1995). Soilless Culture Management. Advanced Series in Agricultural Sciences, vol. 24. Springer, Berlin, Heidelberg.  
[https://doi.org/10.1007/978-3-642-79093-5\\_2](https://doi.org/10.1007/978-3-642-79093-5_2).
2. Hasan, M., Sabir, N., Singh, A.K., Singh, M.C., Patel, N., Khanna, M., Rai, T., Pragnya, P. (2018). Hydroponics Technology for Horticultural Crops, Tech.

Bull.TB-ICN 188/2018. Publ. by I.A.R.I., New Delhi-110012 INDIA.

3. Misra S., Misra S., Misra R.L. (2017). Soilless Crop production. Daya PublishingHouse, Astral International (P) Ltd., New Delhi.
4. Palaniappan S. P., Annadurai K. (2018). Organic Farming: Theory & Practice. Scientific Publisher.
5. Goddek, S., Joyce, A., Kotzen, B., Burnell, G.M. (2019). Aquaponics Food Production Systems. Springer, Cham.

**Suggestive readings:**

1. Jones, J. B. (2014). Complete Guide for Growing Plants Hydroponically. CRCPress.
2. Vayas, S.C, Vayas, S., Modi, H.A. (1998). Bio-fertilizers and organic Farming. Akta Prakashan, Nadiad.