

**Course Code: BOT GE 03**  
**Course Title: Protected Agriculture - Hydroponics and Organic Cultivation**  
**Total Credits: 04 (Theory 02, Practical 02)**  
**Total Hours: Lectures 30 Practical 60**

**Objectives:**

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

**Learning Outcomes:**

- Students will develop a thorough understanding of the concept of Hydroponics, Aquaponics and Organic farming.
- Students will be trained in establishing hydroponic facility<sup>3</sup>. Students will learn the development of various organic products such as biopesticides, biofertilizers and biogrowth promoters.
- Students will understand various government policies in marketing of hydroponic and organic produce.
- Understand Good Agricultural Practices associated with protected agriculture.

**Unit 1: Introduction to Protected Agriculture****Lectures: 02**

Protected Agriculture types (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****Lectures: 05**

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**

**Lectures: 07**

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**

**Lectures: 06**

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**

**Lectures: 06**

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**

**Lectures: 04**

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.
2. Preparation of growth media for hydroponics.
3. Estimation of NPK, DO, TDS, pH of growing media
4. Demonstration of different irrigation techniques in hydroponics.
5. Demonstration of construction of a sustainable hydroponic unit.
6. Perform rapid tests for estimation of NPK in different soil samples (at least three).
7. Bulk density and porosity of soilless media e.g. coco-peat, perlite, vermiculite, expanded clay, rockwool (any two media).
8. Demonstration of growing a leafy vegetable/fruity vegetable/ medicinal

herb/aromatic plant in Hydroponics solution.

9. Study of traditional organic inputs and formulation of biofertilizer.
10. Preparation of biopesticides, plant health promoters like *Panchgavya*, *Beejamrut* etc.
11. Field visit to organic farm/hydroponic farm and submission of visit report.

**Suggested 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 Publishing House, 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.

**Additional Resources:**

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

**Keywords:** hydroponics, aquaponics, organic farming, Dissolved Oxygen-DO, Total Dissolved Solid – TDS, Good Agricultural Practices (GAP) and Integrated Pest Management (IPM), Nutrient Film Technique (NFT), Deep Water Culture (DWC), Dutch Bucket .