

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		
Protected Agriculture – Hydroponics and Organic Cultivation BOT-GE-3	4	2	0	2	-	None

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.
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.