

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 ALS-DSE 13	4	2	0	2	Sem VII	None

Course 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.

Theory : 30 Hours

Unit 1: Introduction to Protected Agriculture

02 hours

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

05 hours

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 and associated pest & diseases**12 hours**

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 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 4: Organic farming and its management, Marketing & Policies**11 hours**

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

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

Practical:**60 hours**

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

Essential/recommended reading:

- 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.
- 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.
- Misra S., Misra S., Misra R.L. (2017). Soilless Crop production. Daya Publishing House, Astral International (P) Ltd., New Delhi.
- Palaniappan S. P., Annadurai K. (2018). Organic Farming: Theory & Practice. Scientific Publisher.
- 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. CRC Press.
2. Vayas, S.C, Vayas, S., Modi, H.A. (1998). Bio-fertilizers and organic Farming. Akta Prakashan, Nadiad.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.