GENERIC ELECTIVE (GE-5)

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		
Hydroponics and Organic Farming ALS BOT GE 05	**4**	**2**	**0**	**2**	Class XII pass with Biology and Chemistry	NA

Learning Objectives

The Learning Outcomes of this course are as follows:

- to provide knowledge and expertise of various aspects of hydroponics, aeroponics and organic farming to the students.
- to become economically self-reliant by growing and marketing organic herbs, vegetables, micro greens and fruits.
- with various acts and regulations related to seeds.

Learning outcomes

By studying this course, students will be able to:

- develop a thorough understanding of the concept of Hydroponics, Aeroponics and Organic farming.
- trained in establishing a hydroponic facility. Students will learn the development of various organic products such as biopesticides, biofertilizers and bio-growth promoters.
- 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 (2 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 (5 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 (7 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, Principles of aeroponics.

Unit 4: Hydroponics associated pest and diseases (4 Hours)

Hydroponics associated pests - 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 (8 Hours)

Introduction to 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, Different concepts of organic farming – Natural farming, Biodynamic farming, Permaculture and Zero Budget Farming

Unit 6: Produce Marketing and Policies (4 Hours)

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

PRACTICAL (60 hours)

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. Study of techniques used in hydroponics (Circulating methods such as Nutrient Film Technique (NFT), Deep Flow Technique (DFT), Dutch bucket; Non circulating methods such as Root dipping, Floating, Capillary action; Aeroponics such as root mist and fog feed techniques.
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. Study of suitable conditions for Hydroponics - quality, light intensity, photoperiod and temperature.
9. Demonstration of growing a leafy vegetable/ fruity vegetable/ medicinal herb/aromatic plant in Hydroponics solution.
10. Study of traditional organic inputs and formulation of biofertilizer.
11. Preparation of biopesticides, plant health promoters like *Panchgavya, Beejamrut*etc.
12. Field visit to organic farm/hydroponic farm and submission of visit report.

Essential/recommended readings

1. Schwarz, M. (1995). *Soilless Culture Management*, *Advanced Series in AgriculturalSciences* (vol. 24). Springer, Berlin, Heidelberg.

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-ICN188/2018. Publ. by I.A.R.I.

3. Misra S., Misra S., &Misra R.L. (2017). *Soilless Crop production*. Daya PublishingHouse, Astral International (P) Ltd.

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 FoodProduction 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*. AktaPrakashan.
3. Jones, J. Benton (2005). *Hydroponics: A Practical Guide for the Soilless Grower* (4thEdition). CRC Press.
4. Roberto, K. (2003). *How to Hydroponics* (4th Ed.). The Future Garden press.

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