

21ELCT184 SOIL - LESS FARMING (HYDROPONICS, AEROPONICS AND AQUAPONICS)

Hours Per Week :

L	T	P	C
1	-	4	3

Total Hours :

L	T	P
15	-	60

COURSE DESCRIPTION AND OBJECTIVES:

Main objective of this subject is to know knowledge about Soil-less farming (Hydroponics, Aeroponics and Aquaponics)

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
1	Students will understand about Hydroponics
2	Students will learn basic concepts in Soil-less Farming
3	Students will learn different methods and components of Soil-less Farming

SKILLS:

- ✓ *Preparation of Media for Hydroponics*
- ✓ *Expertise in different soil-less farming techniques*



Source:

<https://netbuzzafrica.com/shaping-a-new-food-system-with-hydroponics>

ACTIVITIES:

- o Visit to commercial hydroponics unit
- o Calculate the economics of soil-less farming
- o Assignment on success story on soil-less farming

UNIT - 1

Hydroponics: Introduction- history- hydroponics system and its working - why grow crops hydroponically? advantages and disadvantages - additional terminology (aeroponics anthroponics, aquaponics, fogponics, gelponics, folke wall, grow box, grow room, organoponics, passive hydroponics, plant factory, regrowing vegetable, vertical farming, xeriscaping).

UNIT - 2

Types of hydroponic systems: Hydroponics with substrate, real hydroponics without substrate - closed cycle – open cycle - sand culture –types of sand culture techniques (wicking, ebb and flow, drip etc.)- pros. and cons. of each system, solution culture- types of solution culture techniques - static or passive systems (wick system, deep water culture / floating raft etc.,) - active or dynamic systems (ebb & flow, bubbles, NFT etc.,) - types of NFT- pros. and cons. of each system, Advanced hydroponic systems - deep water culture: Kratky method, Dutch bucket system.

UNIT - 3

Aeroponics: history - methods - types of aeroponics – single bucket system – multi bucket system – fogponics - aeroponics in agriculture (vertical farming) - benefits and drawbacks – aeroponics in space – benefits. Aquaponics – methods and types of aquaponics – types of fish to grow and their management – use of bacteria to avoid contamination

UNIT - 4

Materials used and nutrient solutions: growing media or support materials (substrates) – description - pros. and cons. of each material, nutrient solutions - inorganic hydroponic solutions- organic hydroponic solutions – additives - aeration of solutions – EC, pH, TDS and oxygenation level adjustment.

UNIT - 5

System requirements: Hydroponic greenhouse & its components - different models of structures for hydroponic system - lighting, temperature and environmental control - laboratory glass ware, tools and equipment – green house control systems and automation - software – the free and open source tools – HydroBuddy and HydroCal, how to choose the right system, applications of hydroponics in agriculture (roof top gardens, vertical gardens, living walls, vertical farming etc) and in research.

LABORATORY EXPERIMENTS**LIST OF EXPERIMENTS**

1. Introduction to hydroponic technology – hydroponic growing systems – Basics Concepts and Designs, Site considerations, Soilless system selection principles.
2. Plant growth requirements – light, artificial light – light balancers, temperature.
3. Plant growth requirements – nutrition, nutrient requirements, deficiencies, toxicities, pH, EC, salinity, TDS growth regulators, oxygen level.
4. Growing media – Types, Properties, Uses.
5. Hydroponic nutrient solutions - Types, Nutrient formulae/ Composition, Preparing solutions.
6. Hydroponic equipment – componentry, nutrient delivery, pumping and testing.
7. Growing structures – types, design and construction.
8. Environmental control – heating, cooling, lighting, shading, CO₂ enrichment.
9. Plant culture in hydroponics – raising seedlings, nursery keeping and management, Trans planting, trellising, pruning.

10. Irrigation – soil requirements, irrigation systems, irrigation and fertigation management
11. Setting up of hydroponic systems and sand culture systems
12. Setting up a Dutch bucket / Bato bucket hydroponic system
13. The design and set up of nutrient film technique hydroponic system (Flat bed NFT, 'A'
14. Frame – 54, 'A Frame' – 154, Drip bucket system / Kratky method)
15. Deep flow technique for hydroponic crop production
16. Setting up a Dutch bucket deep water hydroponic system
17. Setting up of aeroponic vertical towers and aquaponic system
18. pH, EC and TDS monitoring in hydroponic systems
19. Monitoring water level in hydroponic systems and oxygenation level in hydroponic nutrient solutions
20. Monitoring periodic plant health – Physiological alterations, weeds, pests and diseases
21. Treating algae problems in Dutch bucket hydroponic systems
22. Management of root associated problems in hydroponic cultivation
23. Commercial hydroponics farm set up
24. Managing a commercial hydroponic farm – crop scheduling and selection standards
25. Hydroponic systems cleaning – green house hygiene management
26. Practical tips for optimal management of hydroponic cultivation – management, organization, supervision, daily maintenance
27. Harvest procedures, post-harvest grading, sorting and packing, marketing - promotion and selling. Economics of hydroponic farming
- 28 & 29. Advanced sensor technology to monitor water pH levels in real time, air speed, CO₂ levels, Humidity. light, temperature, oxygen and plant health
30. Software tools for automation in hydroponic system

REFERENCES:

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2. Tom Gordan, 2020. Aquaponics and Hydroponics Gardening 2 in 1, Novelty Publishing LLC
3. Tyler Baras, 2018. DIY Hydroponic Gardens, Cool Springs Press
4. Howard M. Resh, 2012. Hydroponic Food Production: A definitive guide book for the advanced home gardener & the commercial Hydroponic grower, 7th Ed. CRC press
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6. Andy Jacobson, 2016. Hydroponics Essential Guide- A step by step Hydroponic Gardening guide to grow fruits, vegetables and herbs at home, 2nd Ed. (e book)
7. John Mason, 1990. Commercial Hydroponics, Kangaroo Press PVT Ltd
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9. Dickson Despommier, 2010. The Vertical Farm: Feeding the world in the 21st Century

