Syllabus for Water-efficient Irrigation Technician

Course Name	Water-efficient Irrigation Technician
Sector	Agriculture
Course Code	AGR/2024/WEIT/332
Level	4
Occupation	Water-efficient Irrigation Technician
Job Description	A Water-efficient Irrigation Technician is responsible for installing, maintaining, and repairing various types of irrigation systems, including drip irrigation, sprinkler systems, and pipe networks. The candidates also involves to understand the basics of irrigation systems, designing and implementing drip irrigation systems, managing fertigation processes, and ensuring the efficient operation of sprinkler irrigation systems.
Course Duration	**Total Duration 390 Hrs (T-90 , P- 180 , OJT-60 and ES-60)**
Trainees' Entry Qualification	• 12th grade pass • Completed 2nd year of 3-year diploma (after 10th) • Pursuing 2nd year of 3-year regular Diploma (after 10th) • 10th grade pass with two years of any combination of NTC/NAC/CITS or equivalent. • 8th pass plus 2-year NTC plus 1-Year NAC plus 1-Year CITS • 10th grade pass and pursuing continuous schooling (for 2-year program) • 11th Grade Pass and pursuing continuous schooling • Previous relevant Qualification of NSQF Level 3.0 with minimum education as 8th Grade pass with 3-year relevant experience • Previous relevant Qualification of NSQF Level 3.5 with 1.5-year relevant experience
Trainers Qualification	Diploma in Mechanical/ Civil/ Plumbing/ Fitter with 3yrs experience in relevant field OR ITI in Mechanical/ Civil/ Plumbing/ Fitter with 3yrs experience in relevant field OR Graduate in any stream with 10+2 in Science with 3yrs experience in relevant field OR Graduate in Agriculture / Horticulture / Botany/Forestry with 1yrs experience in relevant field OR B.Tech. in Mechanical/ Civil with 0.5yrs experience in relevant field OR B.Tech. in Agriculture engineering

Structure of Course:

Module No.	Module name	Outcome	Compulsory/ Optional	Theory (Hrs)	Practical (Hrs)	Total (Hrs) [Multiple of 30]
1	Basics of irrigation system	Describe the basic of irrigation system	Compulsory	10	20	30
2	Information on drip irrigation system	Explain the drip irrigation system	Compulsory	20	40	60
3	Drip Design procedure	Demonstrate the procedure of drip design	Compulsory	20	40	60
4	Design of pipe network	Illustrate the procedure of pipe network design	Compulsory	10	20	30
5	Fertigation	Demonstrate the techniques of Fertigation	Compulsory	10	20	30
6	Sprinkler Irrigation System	Explain the Sprinkler Irrigation System	Compulsory	20	40	60
7	OJT	Work in real job situation with special emphasis on basic safety and hazards in this domain (OJT).	Compulsory	--	60	60
8	Employability Skill	As per guided curriculum	Compulsory	60	--	60
			TOTAL:	150	240	390

SYLLABUS:

Module No. 1: Basics of irrigation system

Outcome: Describe the basic of irrigation system

Theory Content: introduction, Importance of water conservation, Histories and development of irrigation system, Classification of irrigation systems, Idea about precision irrigation practice

Practical Content: Field visit for showing conventional as well as micro irrigation system.

Tools & Equipment needed: field visit

Module No. 2: Information on drip irrigation system

Outcome: Explain the drip irrigation system

Theory Content: Types of drip irrigation- surface drip, sub-surface drip, bubbler, spray, Advantages and disadvantages of drip irrigation system,

Structure of drip irrigation system-pump, idea on pump types, determination of capacity of pump, total head, net positive suction head, friction head.

Control head, fertilizer tank, filter, types of filters, main lines, sub-main lines and laterals, distributors or emitters.

Practical Content: study of different components of drip irrigation, design a layout and installation of drip irrigation system.

Tools & Equipment needed: components of drip irrigation system, main pipe, lateral pipe, different types and different capacity emitters, accessories to install drip system

Module No. 3: Drip Design procedure

Outcome: Demonstrate the procedure of drip design

Theory Content: Determination of crop water requirements, consumptive use of plants, reference evapotranspiration and crop evapotranspiration, Water distribution in different soils and wetting pattern, Selection of type of emitters-pressure compensating type and non-pressure compensating type, online dripper and inline dripper, connectors selection of number of distributors per plant, determination of emission uniformity of emitters, determination of efficiency of the system, Percentage of area to be wetted, Determination of system capacity

Practical Content: determination of wetting pattern in clay, silt and sandy soil, determination of emission uniformity for given emitter

Tools & Equipment needed: different types of emitters, lateral drip pipes and small plastic cans for determining emission uniformity, tensiometer.

Module No. 4: Design of pipe network

Outcome: Illustrate the procedure of pipe network design

Theory Content: Hydraulic formulae to determine head losses in pipe, Darcy-Weisbach, Hazen-William, Scobey, Design of lateral, sub main and main, Pressure distribution along lateral, sub-main and main, selection of pump

Practical Content: determination of head loss in lateral, sub-main and main lines, determination of diameters of lateral, sub-main and main drip pipe.

Tools & Equipment needed: pressure gauge, water meter, emitters, lateral, submain, mail pipes, pump.

Module No. 5: Fertigation

Outcome: Demonstrate the techniques of Fertigation

Theory Content: Fertigation, Advantages and disadvantages of fertigation, commonly applied fertilizer through drip fertigation, solubility and compatibility of fertilizers, Components of drip fertigation system, Rate of fertilizer application, precaution for successful fertigation, fertigation frequency, methods of fertigation

Practical Content: determination of rate of injection and calibration of fertigation, design for irrigation schedule and fertigation schedule for crops

Tools & Equipment needed: Fertilizer tank (By pass system), venturi injector, Fertilizer injection pump

Module No. 6: Sprinkler Irrigation System

Outcome: Explain the Sprinkler Irrigation System

Theory Content: Classification of sprinkler system based on portability, Types of sprinkler system and components of sprinkler irrigation system, Principles of sprinkler operation, Determination of distribution pattern, Uniformity coefficient, Hydraulic design of main, sub-main and lateral lines, design steps, Selection of pump and power unit.

Practical Content: Study of different components of sprinkler system, design a layout and installation of sprinkler irrigation system, estimation of uniformity coefficient and pattern efficiency.

Tools & Equipment needed: components of sprinkler systems- main, submain and lateral pipes, pump and power unit, sprinkler nozzles, stand

Module No.7 : OJT

Outcome: Work in real job situation with special emphasis on basic safety and hazards in this domain

Practical Content:

Assessor will check report prepared for this component of Practical training of the course and assess whether competency has been developed to work in the real job situation with special emphasis on basic safety and hazards in this domain. (The trainee is expected to undertake work in actual workplace under any supervisor / contractor for 60 Hours.)

Module No. 8: Employability Skills **(60 Hrs)**

Key Learning Outcomes

Introduction to Employability Skills Duration: 1.5 Hours

After completing this programme, participants will be able to:

1. Discuss the Employability Skills required for jobs in various industries
2. List different learning and employability related GOI and private portals and their usage

Constitutional values - Citizenship Duration: 1.5 Hours

3. Explain the constitutional values, including civic rights and duties, citizenship, responsibility towards society and personal values and ethics such as honesty, integrity, caring and respecting others that are required to become a responsible citizen
4. Show how to practice different environmentally sustainable practices.

Becoming a Professional in the 21st Century Duration: 2.5 Hours

5. Discuss importance of relevant 21st century skills.
6. Exhibit 21st century skills like Self-Awareness, Behavior Skills, time management, critical and adaptive thinking, problem-solving, creative thinking, social and cultural awareness, emotional awareness, learning to learn etc. in personal or professional life.
7. Describe the benefits of continuous learning.

Basic English Skills Duration: 10 Hours

8. Show how to use basic English sentences for everyday conversation in different contexts, in person and over the telephone
9. Read and interpret text written in basic English
10. Write a short note/paragraph / letter/e -mail using basic English

Career Development & Goal Setting Duration: 2 Hours

11. Create a career development plan with well-defined short- and long-term goals

Communication Skills Duration: 5 Hours

12. Demonstrate how to communicate effectively using verbal and nonverbal communication etiquette.
13. Explain the importance of active listening for effective communication
14. Discuss the significance of working collaboratively with others in a team

Diversity & Inclusion Duration: 2.5 Hours

15. Demonstrate how to behave, communicate, and conduct oneself appropriately with all genders and PwD
16. Discuss the significance of escalating sexual harassment issues as per POSH act.

Financial and Legal Literacy Duration:5 Hours

17. Outline the importance of selecting the right financial institution, product, and service
18. Demonstrate how to carry out offline and online financial transactions, safely and securely

19. List the common components of salary and compute income, expenditure, taxes, investments etc.
20. Discuss the legal rights, laws, and aids

Essential Digital Skills Duration: 10 Hours

21. Describe the role of digital technology in today's life
22. Demonstrate how to operate digital devices and use the associated applications and features, safely and securely
23. Discuss the significance of displaying responsible online behavior while browsing, using various social media platforms, e-mails, etc., safely and securely
24. Create sample word documents, excel sheets and presentations using basic features
25. utilize virtual collaboration tools to work effectively

Entrepreneurship Duration: 7 Hours

26. Explain the types of entrepreneurship and enterprises
27. Discuss how to identify opportunities for potential business, sources of funding and associated financial and legal risks with its mitigation plan
28. Describe the 4Ps of Marketing-Product, Price, Place and Promotion and apply them as per requirement
29. Create a sample business plan, for the selected business opportunity

Customer Service Duration: 5 Hours

30. Describe the significance of analyzing different types and needs of customers
31. Explain the significance of identifying customer needs and responding to them in a professional manner.
32. Discuss the significance of maintaining hygiene and dressing appropriately

Getting Ready for apprenticeship & Jobs Duration: 8 Hours

33. Create a professional Curriculum Vitae (CV)
34. Use various offline and online job search sources such as employment exchanges, recruitment agencies, and job portals respectively
35. Discuss the significance of maintaining hygiene and confidence during an interview
36. Perform a mock interview
37. List the steps for searching and registering for apprenticeship opportunities

Learning Outcome – Assessment Criteria

Module No.	Outcome	Assessment Criteria
1	Describe the basic of irrigation system	**After completion of this module students will be able to:** • Explain the importance of water conservation and the development of irrigation systems. • Identify and describe the components and functioning of different irrigation systems observed during the field visits. • Compare and contrast various irrigation systems based on their efficiency, water conservation measures, and suitability for different crops and soil types.

Module No.	Outcome	Assessment Criteria
2	Explain the drip irrigation system	**After completion of this module students will be able to:** • Demonstrate comprehension of different types of drip irrigation systems, their advantages, disadvantages, and key components. • Explain the calculation and determination of pump capacity and other hydraulic parameters accurately. • Identify various components of a drip irrigation system. • Design a layout and install a drip irrigation system. • Identify and troubleshoot potential issues related to drip irrigation system design, installation, and operation. • Analyze the suitability of different drip irrigation types and components for specific agricultural scenarios.
3	Demonstrate the procedure of drip design	**After completion of this module students will be able to:** • Demonstrate crop water requirements, emitter selection, and system efficiency. • Determine wetting patterns in different soil types and emission uniformity for given emitters. • Apply appropriate techniques and methodologies in drip design. • Identify and address challenges encountered during drip design. • Make sound decisions in selecting drip components and optimizing system efficiency based on experimental findings.
4	Illustrate the procedure of pipe network design.	**After completion of this module students will be able to:** • Demonstrate hydraulic formulae and principles for determining head losses in pipes. • Design the layout and dimensions of lateral, sub-main, and main pipes effectively.

Module No.	Outcome	Assessment Criteria
		• Determine head losses in different sections of the pipe network. • Calculate pipe diameters precisely based on given flow rates, pressure requirements, and head losses. • Identify and address challenges related to pressure distribution and head losses in the design of pipe networks.
5	Demonstrate the techniques of Fertigation	**After completion of this module students will be able to:** • Determine the rate of injection and calibrate the fertigation equipment accurately. • Execute the design of irrigation and fertigation schedules effectively, considering crop requirements and environmental factors. • Explain fertigation, including its advantages, commonly applied fertilizers, and components of drip fertigation systems. • Select appropriate fertilizers for specific crops and determining fertigation frequency. • Identify and troubleshoot potential issues that may arise during the fertigation process, such as clogging of emitters or inconsistent fertilizer distribution.
6	Explain the Sprinkler Irrigation System	**After completion of this module students will be able to:** • Demonstrate sprinkler irrigation system classification, components, operation principles, hydraulic design, and pump selection. • Design a layout for a sprinkler irrigation system • Select appropriate sprinkler types and components based on specific irrigation requirements. • Troubleshoot common issues encountered during the installation or operation of sprinkler systems.
7	OJT	Assessor will check report prepared for this component of Practical training of the course and assess whether competency has been developed to work in the real job situation with special emphasis on basic safety and hazards in this domain. (The trainee is expected to undertake work in actual workplace under any supervisor / contractor for 60 Hours.)
8	Employability Skill	As per guided curriculum

List of Tools, Equipment & materials needed for 30 Trainees (Practical)

	Drip Irrigation		
Sl No	**Items Name**	**Specification**	**Qty**
1	Pump		1
2	Delivery Pipe		As per need
3	Fertilizer Tank, venturi injector, Fertilizer injection pump		1
4	Screen Filter/Filter unit (Desirable Hydrocyclone filter)		1
5	Pressure Gauge with suitable fittings Water meter		1
6	Straight connector		1
7	Main line (2.5 to 4 inches diameter PVC) (it should be buried at least 45cm from ground surface)		As per need
8	Tee connecter		1
9	Bend with coupler (90°)		1
10	Control Valve (40mm PVC pipe)		2
11	Sub-main (40mm PVC pipe)		2
12	Flush valve		2
13	Take up connecter (12 mm, 16 mm etc.)		30
14	Grommet (12 mm, 16 mm etc.)		30
15	Cock (12 mm, 16 mm etc.)		30
16	Lateral Pipe (12 mm, 16 mm etc.)		As per need
17	Dripper/emitter (online type, capacity 2lph/ 4lph/ 6lph or adjustable)		300
18	End cap (12 mm, 16 mm etc.)		30
19	Tee, Elbow, Straight connecter (12 mm, 16 mm etc.), Teflon etc.		As per need
20	Hole puncture (12 mm, 16 mm etc.)		As per need
21	Sub-laterals		As per need
	Sprinkler Irrigation		
Sl No	**Items Name**	**Specification**	**Qty**
1	Pump		1
2	Delivery Pipe		As per need
3	By Pass Valve		1
4	Fertilizer Tank (If needed)		1
5	Screen Filter		1
6	Pressure Gauge		1
7	Straight connector		As per need
8	Main line (Sub-mains if needed) {HDPE/PVC pipes 50 mm diameter with quick action coupler 2.5kgf/cm^2}		1
9	Tee with coupler		1
10	Bend with coupler (90°)		2
11	Control Valve		2
12	Lateral Pipe		2
13	Sprinkler Coupler with foot baton assembly		30

	Drip Irrigation		
Sl No	**Items Name**	**Specification**	**Qty**
14	Riser Pipe (20 mm diameter with, 75cm long)		30
15	Sprinkler head unit (Nozzles 1.7 to 2.8kgf/ cm^2)		30
16	End Plug/Cap		As per need

Marks Distribution

Outcome	Outcome Code	Total Th marks	Total Pr marks	Total OJT marks
Describe the basic of irrigation system	AGR/0266/OC1	20	80	0
Explain the drip irrigation system	AGR/0266/OC2	30	130	0
Demonstrate the procedure of drip design	AGR/0266/OC3	30	130	0
Illustrate the procedure of pipe network design	AGR/0266/OC4	20	90	0
Demonstrate the techniques of Fertigation	AGR/0266/OC5	20	90	0
Explain the Sprinkler Irrigation System	AGR/0266/OC6	30	130	0
Work in real job situation with special emphasis on basic safety and hazards in this domain (OJT).	AGR/0266/OC7	0	0	150
Employability Skills – 60 Hrs	DGT/VSQ/N0102	50	0	0