National Vocational Qualification level – 3

"Tunnel Farming, Green House & Agribusiness"

(Off-season Vegetable production & Agribusiness)

(Curriculum)

National Vocational and Technical Training Commission (NAVTTC)
Government of Pakistan

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Tunnel Farming, Green House & Agribusiness

1. Introduction

Agriculture is considered as the backbone of Pakistan's economy, which accounts for about 18.9% of Pakistan's GDP and employs about 42.3% of the labor force. Where agriculture is considered as the largest sector that supports GDP, horticulture sector (fruit and vegetables) contributes only 11 % to the total value addition. Pakistan exports vegetables to Afghanistan, Malaysia, Russia, Bahrain, UAE and Sri Lanka but not impressive figures. Despite favorable climatic and cropping condition Pakistan has repeatedly seen shortages of different vegetables like onions or tomatoes in the market that caused price rise and difficulty for many people. More than 35 varieties of vegetables are growing in different climatic zones in different provinces of Pakistan. Many Surveys reports different reasons for low production of vegetables in Pakistan. The government in history executed various projects to urge the farmer community for cultivation of vegetables but due to lack of technical skills and limited resources, farmers have not adopted this sector in a very impressive way.

Vegetable production can be heightening by improving cultivation techniques and enhancing profitability for farmers. Off-season vegetable production is also an important technique to enhance profits and meet market demand. Production of vegetables out of normal season through different techniques is called “off-season vegetable”. Growing Off-season vegetables not only provides fresh vegetables to the daily dietary meal of the consumers but also helps farmers to get abnormal profit as supply in the off-season is always lower than that of its demand.

Therefore, the importance of knowledge related to off-season vegetable production through the latest techniques makes this diploma very valuable not only in agriculture but also in its usefulness in all areas of our daily life. Market demands for qualified workers are therefore a need for time and can only be addressed by developing specific skills standards in partnership with all stakeholders and industry experts. Recognizing this fact, the National Vocational and Technical Training Commission (NAVTTC) has developed the National Vocational Qualifications Framework (NVQF) for tunnel farming, Greenhouse and agri. Business (off season vegetable production) qualifications. These competency standards have been developed by the Qualification Development Committee (QDC) and validated by the Qualification Validation Committee (QVC) with representation from the country's leading departments (IAGS, PU Lahore, UVAS, UAF, PCSIR and ARI KPK.

2. Purpose of the training program:

The aim of this qualification is to set high and applicable professional standards for all stake holders in agriculture sector. The basic goals of establishing these credentials are as follows:

1. Equip with the latest off-season vegetable production techniques
2. Improve trainees' professional competence
3. Provide opportunities for recognition of non-formal or informal skills
4. Raise standard and efficacy of scientific training and assessment
5. Improve crop production through the best management skills
6. Enable the existing workforce to learn new technologies and methods
7. Producing a skilled workforce for off-season vegetable production

3. Overall objectives of training program:

The main objectives of the Tunnel Farming, Greenhouse & Agribusiness (Level-3) are as follows:

1. Prepare for Nursery Raising and site Selection
2. Perform Seed Sowing (Conventional)
3. Perform Seed Sowing (Modern technique)
4. Perform Nursery Management Practices
5. Transport Nursery Seedlings
6. Perform Nursery Marketing
7. Select and procure material required for Greenhouse
8. Install Greenhouse Structures
9. Maintain Greenhouse Structure
10. Operate greenhouse components
11. Perform greenhouse Operations

12. Perform IPM and IDM
13. Apply Basic Computer skills to create a variety of Document
14. Operate digital media technology
15. Create user documentation
16. Create technical documentation
17. Use social media tools for collaboration and engagement
18. E-Commerce – SEO (Search Engine Optimization)
19. E-Commerce – SCM (Supply Chain Management)
20. E-Commerce – Social Media Marketing

4. Competencies to be gained after completion of course:

At the end of the course, the trainee has attained the following core competencies:

National Qualification in the Tunnel Farming, Greenhouse & Agribusiness (Level-3).

1. Prepare for Nursery Raising and site Selection
2. Perform Seed Sowing (Conventional)
3. Perform Seed Sowing (Modern technique)
4. Perform Nursery Management Practices
5. Transport Nursery Seedlings
6. Perform Nursery Marketing
7. Select and procure material required for Greenhouse
8. Install Greenhouse Structures
9. Maintain Greenhouse Structure
10. Operate greenhouse components
11. Perform greenhouse Operations
12. Perform IPM and IDM

5. Entry level of trainees:

The entry for National Vocational Certificate level 3, in "**Tunnel Farming, Greenhouse & Agribusiness**" are given below:

Title	Entry requirements
National Vocational Certificate level 3, in **Tunnel Farming, Greenhouse & Agribusiness**	Entry for assessment for this qualification is open. However, entry into formal training institutes, based on this qualification is candidate having **SSC** and National Vocational Certificate level 2, in **Tunnel Farming, Greenhouse & Agribusiness**

6. Minimum qualification of trainer/instructor:

- Must be a holder of Bachelor of Engineering in Agricultural Engineering/ B.Sc. (Hons.) Agriculture/equivalent or Bachelor of Technology in Agricultural Engineering (with three years of experience)
- Must be able to communicate effectively both orally and in written form.
- Must be able to perform all competences, given in **Tunnel Farming, Greenhouse & Agribusiness Level-3**

7. Recommended trainer: trainee ratio

The recommended maximum trainer: trainee ratio for this program is 1 trainer for 20 to 25 trainees.

8. Medium of instruction i.e. language of instruction:

Instructions will be in Urdu/ English/ Local language.

9. Duration of the course (Total time, Theory & Practical time):

The distribution of contact hours is given below:

Total	**-**	**610 hours**
Theory	**-**	**142 hours (23.3%)**
Practical	**-**	**468 hours (76.7%)**

10. Description and structure of the course

Following is the structure of the course:

Code	Competency Standard	Category	Theory	Practical	Total	Credit
CS11	Prepare for Nursery Raising and site selection	Technical	6	24	30	3
CS12	Perform Seed Sowing (Conventional)	Technical	10	30	40	4
CS13	Perform Seed Sowing (Modern technique)	Technical	10	30	40	4
CS14	Perform Nursery Management practices.	Technical	6	24	30	3
CS15	Transport Nursery seedlings	Technical	5	15	20	2
CS16	Perform Nursery Marketing	Technical	6	24	30	3
CS17	Select and procure material required for Greenhouse	Technical	10	30	40	4
CS18	Install Greenhouse structures	Technical	17	63	80	8
CS19	Maintain Greenhouse structure	Technical	5	15	20	2
CS20	Operate Greenhouse components	Technical	6	24	30	3
CS21	Perform Greenhouse Operations	Technical	5	15	20	2
CS22	Perform IPM and IDM	Technical	16	54	70	7

CS23	Apply Basic Computer skills to create a variety of Documents	Generic	5	15	20	2
CS24	Operate digital media technology	Generic	5	15	20	2
CS25	Create user documentation	Generic	5	15	20	2
CS26	Create technical documentation	Generic	5	15	20	2
CS27	Use social media tools for collaboration and engagement	Generic	5	15	20	2
CS28	E-Commerce – SEO (Search Engine Optimization)	Generic	5	15	20	2
CS29	E-Commerce – SCM (Supply Chain Management)	Generic	5	15	20	2
CS30	E-Commerce – Social Media Marketing	Generic	5	15	20	2
	Total		**142**	**468**	**610**	**61**
	Percentage (%)		**23.3**	**76.721**		

Tunnel Farming, Green House & Agribusiness

Level 3

Module: 11. Prepare for Nursery Raising and Site Selection

Objective: After the completion of this module, the Trainee will be able to choose suitable site and seeds for nursery sowing.

Duration: 30 Hours **Theory: 6 Hours** **Practice: 24 Hours** **Credit Hours: 3**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Prepare work plan for Nursery raising	**Trainee will be able to:** • Prepare plan of concerned task • Arrange Implements of required task • Ensure Safety measures and Hygienic conditions	• Define nursery raising protocols • Describe key tasks for nursery management • Explain types and classification of nurseries • Knowledge of health and safety measures	**Theory-** 1 Hrs **Practical-** 5 Hrs **Total-** 6 Hrs	• Pencil • Eraser • Sharpner • Drawing sheet • First Aid Kit	Classroom Lab/ Field Visit

		Practical Activity: Make a layout plan for nursery raising			
LU2. Select site for Nursery raising	**Trainee will be able to:** • Perform site visit to check suitable portion of land • Take permission from respective authority. • Cordon off the area as per standard procedure	• Explain factors to consider in selecting the ideal nursery site (soil workability and drainage, soil texture, water supply, land cost, climate and soil depth) • Describe rules and regulations for nursery development • State the criteria and guidance from respective authorities for nursery operations **Practical Activity:** Perform field visit to check accessibility, water supply and	**Theory-** 2 Hrs **Practical-** 6 Hrs **Total-** 8 Hrs	• Compass • Measuring Tape • Spade	Classroom Lab/ Field Visit

		facilities for choosing nursery site.			
LU3. Select seeds for Nursery raising	**Trainee will be able to:** • Collect and study Weather, soil, and water analysis Reports • Collect required Label information for selection as per your microclimate • Collect Data for past performance on prescribed Performa • Perform Economic Analysis according to selection criteria	• Define seed quality • Explain seed types • Enlist factors that effects seed selection (sowing quality, germination capacity and free from infection) • Describe different type of soils • Explain the effect of soil on seed germination • Describe methods for soil and water analysis • Define suitable environmental conditions for nursery raising • Understand lab analysis report	**Theory-** 2 Hrs **Practical-** 6 Hrs **Total-** 8 Hrs	• Pencil • Eraser • Sharpner • Calculator	Classroom Lab/ Field Visit

		• Knowledge of past performance criteria (climate, soil, water, topography and previous land use) • Describe economic analysis for nursery development (production potential, land availability and cost) **Practical Activity:** Conduct a field visit to select a suitable area for nursery raising			
LU4. Carry out seed viability test by following standard procedures	**Trainee will be able to:** • Perform seed sorting for the experiment • Perform required germination test as per standard method • Maintain growth conditions for	• Define seed purity and quality • Describe the protocol for seed grading • Explain seed germination test	**Theory-** 2 Hrs **Practical-** 6 Hrs **Total-** 8 Hrs	• Pencil • Eraser • Sharpner • Calculator • Measuring scale • Germination chamber	Classroom Lab/ Field Visit

	those seeds • Calculate the germination percentage • Calculate the required seed	• State significance of a seed germination test • Discuss principles and methods for seed germination • Describe necessary conditions for seed growth (water, oxygen and proper temperature) • Explain five stages of seed germination • Discuss germination rate and germination percentage • Describe the best formula for calculating seed germination rate **Practical Activity:** Make a group of two students to perform germination test for any five			

		different seeds and calculate percentage germination			

Module: 12. Perform Seed Sowing (Conventional)

Objective: After the completion of this module, the Trainee will be able to select site and prepare seed beds for nursery sowing.

Duration: 40 Hours **Theory: 10 Hours** **Practice: 30 Hours** **Credit Hours: 4**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Prepare work for seed sowing	**Trainee will be able to:** • Prepare plan of concerned task • Arrange Implements of required tasks • Ensure Safety measures and Hygienic conditions	• Define seed • Describe different methods of seed sowing • Enlist basic tools for planting seeds • Knowledge of health safety measures **Practical Activity:** Prepare a layout plan for seed sowing	**Theory-** 2 Hrs **Practical-** 4 Hrs **Total-** 6 Hrs	• Pencil • Eraser • Sharpner • Drawing sheet	Classroom Lab/ Field Visit

LU2. Prepare Media for seed bed	**Trainee will be able to:** • Identify and arrange mixing materials and its storage for further use • Calculate the quantity of materials according to requirement • Preparation of media as per standard method and conditions • Ensure the required Safety measures	• Define growth media • Enlist materials required for media preparation • Enlist different commercially available growth media. • State the characteristics of growth media • Describe growing media for healthy seedling production • Explain material calculation protocol • Discuss methods and conditions for media preparation • Describe the composition of conventional media **<u>Practical Activity:</u>** Make a report on different media use for seedbeds	**Theory-** 2 Hrs **Practical-** 6 Hrs **Total-** 8 Hrs	• Pencil • Eraser • Sharpner • Calculator • Measuring scale • Plug trays • Polythene bags • Earthen Pots • Plastic pots • Growth media • Shovel • Spade	Classroom Lab/ Field Visit

		preparation			
LU3. Prepare seedbeds	**Trainee will be able to:** • Prepare a layout plan for sowing • Implement layout plan • Perform tagging and fencing of area according to the requirement	• Define soil and its types • Describe layout plan for seed bed preparation • Define characteristics of a good seedbed • Discuss benefits for seedbed preparation • Knowledge of selected field marking/labelling **<u>Practical Activity:</u>** Perform group activity to prepare different types of seedbeds	**Theory-** 2 Hrs **Practical-** 6 Hrs **Total-** 8 Hrs	• Pencil • Eraser • Sharpner • Drawing sheet • Plug trays • Polythene bags • Earthen Pots • Plastic pots • Growth media • Shovel • Spade	Classroom Lab/ Field Visit

LU4. Perform Seed Treatment	**Trainee will be able to:** • Identify soil borne diseases of seed • Identify and arrange respective chemicals • Perform seed treatment process as per SOPs	• Define seed vigour. • Explain soil borne and seed borne diseases • Discuss the purpose of seed treatment • Describe the use of chemicals • Discuss the role of chemicals **<u>Practical Activity:</u>** Perform a group activity to treat seeds with different pesticides	**Theory-** 2 Hrs **Practical-** 7 Hrs **Total-** 9 Hrs	• Stationary • Bins and containers • Glass jar • Chemicals • PPEs kit • Filter paper • Blotter sheets • Tags • Plastic baskets	Classroom Lab/ Field Visit
LU5. Perform Seed Sowing	**Trainee will be able to:** • Identify and arrange the required material for sowing • Perform sowing as per standard method • Perform top-dressing according	• Describe seed types • Define seed sowing protocol • Explain traditional methods of sowing • Discuss materials required for sowing • Describe basic steps for	**Theory-** 2 Hrs **Practical-** 7 Hrs **Total-** 9 Hrs	• Spade • String • Measuring Tape • Measuring scale	Classroom Lab/ Field Visit

	to standard requirements • Ensure Hygiene at workplace according to set standards	seed sowing • Define top-dressing • Enlist materials use for top-dressing • Explain standard procedures use for seed dressing **<u>Practical Activity:</u>** Perform a group activity on seed sowing and their top-dressing through conventional methods			

Module: 13. Perform Seed Sowing (Modern technique)

Objective: After the completion of this module, the Trainee will be able to perform seed sowing for offseason vegetable & fruit production at standard method.

Duration: 40 Hours **Theory: 10 Hours** **Practice: 30 Hours** **Credit Hours: 4**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Prepare work plan for seed sowing	**Trainee will be able to:** • Prepare plan for a concerned task • Arrange Implements of required tasks • Ensure Safety measures and Hygienic conditions	• Define sowing • Describe seed sowing preparation method • Enlist basic tools for planting seeds • Knowledge of health and safety measures **Practical Activity:** Prepare a layout plan for seed	**Theory-** 2 Hrs **Practical-** 4 Hrs **Total-** 6 Hrs	• Pencil • Eraser • Sharpner Drawing sheet	Classroom Lab/ Field Visit

		sowing			
LU2. Prepare media for seed sowing	**Trainee will be able to:** • Identify and arrange potting materials as per standard requirement • Identify and arrange rooting media according to standard requirement • Prepare media according to standard requirement • Perform media filling and compressing as per standard requirement • Ensure health and safety standards	• Define seed and soil types • Explain germination media • Enlist materials use for seed sowing • Describe best seed starting mix • Discuss potting mix media • Enlist basic rooting medium • Discuss essential steps for media preparation and pot filling **Practical Activity:** Make a group of two students and prepare rooting media for different seeds	**Theory-** 2 Hrs **Practical-** 6 Hrs **Total-** 8 Hrs	• White Chalk • Tags • Tray (78, 128, 200) • Polythene bags • Plastic pots • Growth media • Shovel • Spade	Classroom Lab/ Field Visit

LU3. Perform Seed Treatment	**Trainee will be able to:** • Identify seed dormancy and soil borne diseases according to set standards • Perform seed priming according to standard methods • Identify and arrange required chemicals for treatment of soil borne diseases • Perform seed treatment for soil borne diseases as per standard methods • Maintain hygiene conditions and maintain record	• Define seed dormancy • Discuss the types and causes of seed dormancy • Describe cure measures to break seed dormancy • Define seed priming • Explain the advantages of seed priming • Discuss the role of soil borne diseases on seeds • Describe different approaches to treat soilborne diseases (cultural, physical and chemical) • Knowledge of chemicals used for seed treatment • Define active ingredients **<u>Practical Activity:</u>** Perform a group activity to treat seeds with different chemicals	**Theory-** 3 Hrs **Practical-** 10 Hrs **Total-** 13 Hrs	• White Chalk • Tags • Tray (78, 128, 200) • Measuring Tape • Measuring scale	Class Room Lab/ Field Visit

		as per standard methods.			
LU4. Perform Seed Sowing and Top Dressing	**Trainee will be able to:** • Prepare and implement layout • Perform seed sowing as per standard methods • Perform top dressing according to set standards • Ensure placing in the germination chamber with favorable environmental conditions • Perform post management and care	• Discuss the importance of seed depth • Explain seed planting depth standards • Describe modern seed sowing methods • Enlist modern tools for seed sowing • Explain benefits of top dressing • Describe the best topdressing materials • Knowledge of required moisture conditions for seed germination • Discuss environmental conditions that affect germination process • Explain best conditions for	**Theory-** 3 Hrs **Practical-** 10 Hrs **Total-** 13 Hrs	• White Chalk • Tags • Measuring Tape • Peat moss • Vermiculite • Coconut coir	Classroom Lab/ Field Visit

		germination **Practical Activity:** Make a group activity to carry out seed sowing by using different methods			

Module: 14. Perform Nursery Management Practices

Objective: After the completion of this module, the Trainee will be able to germinate, raise, and protect seeds from diseases, insects and abiotic factors leading towards the successful nursery raising.

Duration: 30 Hours **Theory: 6 Hours** **Practice: 24 Hours** **Credit Hours: 3**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Prepare work for nursery management	**Trainee will be able to:** • Prepare plan for a concerned task • Arrange Implements of required tasks • Ensure Safety measures and Hygienic conditions	• Define nursery • Describe nursery types • Discuss objectives of nursery establishment • Explain advantages of nursery management • Describe nursery components • Enlist tools and equipment required for nursery	**Theory-** 2 Hrs **Practical-** 4 Hrs **Total-** 6 Hrs	• Pencil • Eraser • Sharpner Drawing sheet	Classroom Lab/ Field Visit

		management practices • Knowledge of health and safety measures. **Practical Activity:** Prepare a layout plan for nursery management			
LU2. Perform nursery management practices	**Trainee will be able to:** • Perform data collection (Record Keeping) of relative humidity and temperature from Hygrometers • Take reading on daily basis • Ensure nutrient supply (as per schedule and symptoms) • Perform irrigation after intervals	• Define abiotic factors • Knowledge of seasonal crop plants • Describe nursery raising techniques • Discuss nursery management practices • Define data collection for nursery management • Discuss the role of essential nutrients in plants	**Theory-** 2 Hrs **Practical-** 10 Hrs **Total-** 12 Hrs	• Pencil • Eraser • Sharpner • Drawing sheet • Scotch Tape • Measuring Tape • Watering cane • Covering sheet	Classroom Lab/ Field Visit

	• Identify weeds and their eradication • Perform thinning of plants • Maintain suitable environment at nursery	• Explain nutrient management practices • Enlist common irrigation methods • Describe the best irrigation system for open nurseries • Enlist annuals, biennials and perennials weeds • Discuss common methods of weed control • Define herbicides • State the importance of plant thinning • Explain thinning types (low, crown and selection) • Describe thinning methods (Mechanical, ordinary, crown, free, crab's advance and numerical thinning) • Discuss thinning effects			

		• Define ideal environment and facilities for growing nursery plants **Practical Activity:** Conduct field visit to perform nursery management practices.			
LU3. Perform pest and diseases control	**Trainee will be able to:** • Perform Identification of pests and diseases of nursery • Identify and arrange required pesticides • Perform required pesticide application according to SOPs • Perform post pesticide application care	• Define biotic factors • Explain plant pathogenic fungi, bacteria and pests • Discuss common diseases of nursery plants (Powdery mildew, Black spot, Bacterial canker or Blight, etc.) • Discuss common insect pests of nursery plants (Aphids, Leaf miner, Scale insects, Spider, mite, Weevil, etc.) • Knowledge of pesticides • Discuss the role of chemical	**Theory-** 2 Hrs **Practical-** 10 Hrs **Total-** 12 Hrs	• Scotch Tape • Measuring Tape • Measuring scale • Watering cane • Covering sheet • Pesticides • Spray mechine with different nozzles	Classroom Lab/ Field Visit

		control for nursery pest and diseases • Describe application of different pesticides • Explain suitable spray time for pesticides • Knowledge of safety precautions for spraying pesticides **Practical Activity:** Make a group of five students for pest identification and the application of pesticides according to the requirement			

Module: 15. Transport Nursery Seedlings

Objective: After the completion of this module, the Trainee will be able to perform task of nersery transportation that covers nursery hardening process, its packing to safe delivery to concerned field of transplantation.

Duration: 20 Hours **Theory: 5 Hours** **Practice: 15 Hours** **Credit Hours: 2**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Prepare plan for nursery transportation	**Trainee will be able to:** • Prepare plan of concerned task • Arrange Implements of required task • Ensure safety measures and hygienic conditions	• Enlist vehicles use for nursery plants transportation (vans, pickup trucks, etc.) • Enlist tools and implements use for nursery practices • State the protocol to move long distances with nursery plants • Discuss the protocols for tall	**Theory-** 1 Hrs **Practical-** 1 Hrs **Total-** 2 Hrs	• Pencil • Eraser • Sharpner Drawing sheet	Classroom Lab/ Field Visit

		plants transportation • Explain the method to transport plants without soil • Knowledge of health and safety measures **Practical Activity:** Prepare a layout plan for nursery transportation			
LU2. Perform conventional nursery transportation	**Trainee will be able to:** • Perform order management as per customer's demand • Perform hardening method as per requirement • Perform required procedure before uprooting • Perform packaging, stacking,	• Discus seedling preparations for transportation • State the best time to transport plants • Enlist nursery operations (soil management, planting procedures, control of seedling density, use of fertilizers, irrigation, and	**Theory-** 2 Hrs **Practical-** 7 Hrs **Total-** 9 Hrs	• White chalk • Cartons • Jute Bags • Jute Rope • Polythene Sheets • Trays	Class Room Lab/ Field Visit

	and covering of vehicle to protect from weather harshness	pest control) • Describe hardening in nursery • Discuss hardening methods before transportation • Describe conventional uprooting protocols • Knowledge about different vegetables tenderness • Describe conventional transportation types and strategies • State the procedures to maintain logbooks according to customer demand **Practical Activity:** Prepare a report on conventional transportation of nursery plants.			

LU3. Perform modern nursery transportation	**Trainee will be able to:** • Perform order management as per customer's demand • Perform hardening process as per set methods • Perform packaging, stacking, and covering of vehicle to protect from weather harshness	• Describe modern uprooting protocols • Describe hardening in nursery • Discuss hardening methods before transportation • Describe modern transportation types and strategies • Discuss the standard protocol to wrap plants and vehicles for transportation **Practical Activity:** Prepare a report on modern transportation of nursery plants	**Theory-** 2 Hrs **Practical-** 7 Hrs **Total-** 9 Hrs	• White chalk • Cartons • Jute Bags • Jute Rope	Classroom Lab/ Field Visit

Module 16. Perform Nursery Marketing

Objective: After the completion of this module, the Trainee will be able to This competency standard covers the skills and knowledge required to market the produce at commercial level, aiming to extend the business via both conventional and Digital Marketing system

Duration: 30 Hours **Theory: 6 Hours** **Practical: 24 Hours** **Credit Hours: 3**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Prepare for Nursery transportation	**Trainee will be able to:** • Arrange Implements for required task • Prepare plan for transportation • Ensure safety measures and hygienic conditions	• Explain different types of transports (vans, trucks). • Describe the types of the vehicles according to the product. • Describe the safety methods. • Explain the hygiene conditions as per WHO standards.	**Theory-** 2 Hrs **Practical-** 8 Hrs **Total-** 10 Hrs	• Pencil • Eraser • Sharpener • Calculator • Computer unit & internet	Classroom/ Training Workshop

		Practical Activity: Sketch a layout plan for transportation.			
LU2. Conventional Marketing	**Trainee will be able to:** • Perform identification of conventional marketing units • Perform advertisement strategy and follow-up • Calculate its potential via sale and expenses	• Define conventional marketing. • State different channels available for conventional marketing e.g., manufacturer, wholesaler, distributors & retailers • Explain the types of traditional marketing (print, broadcast, direct mail, phone, and outdoor advertising like billboards). • Explain the methods of sales. • Discuss the expenses for marketing of commodity. **Practical Activity:** Perform group activity for designing product advertisement for brochures.	**Theory-** 2 Hrs **Practical-** 8Hrs **Total-** 10 Hrs	• Pencil • Eraser • Sharpener • Calculator • Computer unit & internet • Wooden stalls • Charts • Markers • Play cards • Cardboards	Classroom/ Training Workshop

		OR Make a group of five students to perform indoor activity for launching and sale of consuming products.			
LU3. **Digital Marketing**	**Trainee will be able to:** • Identify digital marketing sources • Advertisement on digital media as per standards and perform follow-up • Calculate its potential	• Define digital marketing. • Explain the digital marketing activities e.g., Search engine optimization (SEO), search engine marketing (SEM),content marketing, influencer marketing, content automation, campaign marketing, and e-commerce marketing, social media marketing, social media optimization, e-mail direct marketing, display advertising, e–books etc. • Explain the advantages of digital marketing in comparison to conventional marketing. **<u>Practical Activity:</u>**	**Theory-** 2 Hrs **Practical-** 8 Hrs **Total-** 10 Hrs	• Pencil • Eraser • Sharpener • Calculator • Computer unit • Wooden stalls • Charts • Markers • Internet • Camera	Classroom/ Training Workshop

		Make a group of students to perform different activities for advertisement of the product.			

Module 17. Select and procure material required for Greenhouse

Objective: After the completion of this module, the Trainee will be able to select suitable material to build different types of Greenhouse and to procure the suitable materials.

Duration: 40 Hours **Theory: 10 Hours** **Practical: 30 Hours** **Credit Hours: 4**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Select foundation material	**Trainee will be able to:** • Collect data of climate and site conditions. • Select durable and corrosion resistant material. • Select suitable material as per standards.	• Understand weather and climate conditions in accordance to crop type. • Discuss the soil and site as per crop requirement. • Explain different types of materials required for construction of greenhouse (wood, wires, galvanized steel, iron, aluminum, concrete etc). **Practical Activity:** Make a group of five students to make feasibility	**Theory-** 2 Hrs **Practical-** 4 Hrs **Total-** 6 Hrs	• Pencil • Eraser • Sharpener • Calculator • Drawing sheet • Measuring tape • Support bars • Iron bars • Aluminium bars • Wires • Steel rods • Wood pieces/piles	Classroom/ Training Workshop

		report of different greenhouse structures.			
LU2. Select greenhouse structure material	**Trainee will be able to:** • Select support bars/stacking for climbing plants • Select suitable material to walk underneath • Select structure for side vents as per standards • Select covering materials (glass, flexible plastic films, rigid plastic sheet) as per requirement • Select required materials (wood or metal) for frame	• Define structure of greenhouse. • Explain the conditions necessary for construction of greenhouse. • Enlist the types of covering material glass, flexible plastic films, rigid plastic sheet) • State the properties of covering material. • Enlist the flooring materials for greenhouse (concrete, porous concrete, gravel, and dirt). • Enlist different types of greenhouses (glass greenhouse, polycarbonate greenhouse, polyethylene, fiber glass, PVC fabric). • Enlist four basic style of greenhouse (lean-to, even-span, uneven-span, ridge-and-furrow, retractable-roof, and shadehouse). • Discuss about different materials for installation of irrigation and ventilation systems. **Practical Activity:**	**Theory-** 2 Hrs **Practical-** 8 Hrs **Total-** 10 Hrs	• Pencil • Eraser • Sharpener • Calculator • Computer unit & internet • Drawing sheet • Measuring tape • Support bars • Iron bars • Aluminium bars • wires • Steel rods • Wood pieces/piles • Concrete • gravel • plastic sheets • fiber glass • PVC fabric • Polyethylene sheets	Classroom/ Training Workshop

		Identify and select materials to construct greenhouse (flooring material or covering material)			
LU3. Conduct market survey for procurement of material	**Trainee will be able to:** • Plan market survey according to prescribed standard • Collect data of material required for greenhouse structure on prescribed format • Ensure health and safety standards	• Define market survey • Explain the properties of materials required for greenhouse structure • State the safety and health procedures as per standards. **<u>Practical Activity:</u>** Make a group of five students to survey market and prepare report on availability of structural material for greenhouse.	**Theory-** 2 Hrs **Practical-** 6 Hrs **Total-** 8 Hrs	• Pencil • Eraser • Sharpener • Calculator • Computer unit & internet • Notepads	Classroom/ market
LU4. Perform procurement	**Trainee will be able to:** • Select greenhouse structure material as per	• Discuss the best material for covering of greenhouse. • Enlist the three basic parts of the greenhouse (trusses, purlins, and side posts) • Discuss the standard procurement procedures.	**Theory-** 2 Hrs **Practical-** 6 Hrs	• Pencil • Eraser • Sharpener • Calculator • Computer unit & internet • Notepads	Classroom/ Lab / Field

	job requirement • Procure the greenhouse structure material as per standards • Manage the labour to load and unload materials • Ensure health and safety standards	• Discuss the procedures for loading and unloading of structural materials. **Practical Activity:** Prepare a report on procuring structural materials including total expenses of transport and labour.	**Total-** 8 Hrs	• Pipes • frames	
LU5. Quality assurance	**Trainee will be able to:** • Ensure the quality of materials • Ensure the durability, weight, light transmission, and breakage of covering materials	• Define quality assurance • Discuss the protocols of quality assurance (checklists, process standards, process documentation and project audit) • Enlist the methods of quality assurance for greenhouse materials (durability, weight, light transmission, and breakage. **Practical Activity:** Conduct a field visit and prepare a report on quality	**Theory-** 2 Hrs **Practical-** 6 Hrs **Total-** 8 Hrs	• Pencil • Eraser • Sharpener • Calculator • Computer unit • Wooden stalls • Charts • Markers • Internet • Camera	Classroom/ Training Workshop

	• Ensure quality of pipes or foundation material	of material used in greenhouse construction.			

Tunnel Farming, Green House & Agribusiness

Module 18. Install Greenhouse structure

Objective: After the completion of this module, the Trainee will be able to install different materials to construct a greenhouse.

Duration: 80 Hours **Theory: 17 Hours** **Practical: 63 Hours** **Credit Hours: 8**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Select greenhouse structure	**Trainee will be able to:** • Identify and arrange the tools as per job requirement • Collect data about desired crop/s • Collect data about climate of the area • Collect geographical data of the selected site • Select the most suitable type of greenhouse based on the collected data • Maintain record	• Describe the tools as per operation in greenhouse (wandering wand, pruner, bucket, broom, dustpan, scissors, storage tubs, tool holders, measuring tape, markers etc.) • Discuss the conditions regarding growing crop (weather, soil, season, fertilizer, irrigation, nutrients, diseases etc.) • Explain the data regarding geographical conditions of the field (Mountains, hills, plateaus, and plains)	**Theory-** 2 Hrs **Practical-** 8 Hrs **Total-** 10 Hrs	• Pencil • Eraser • Sharpener • Calculator • Computer unit & internet • Markers • Tapes • Drawing sheet • Measuring tape • Maps • logbooks • Measuring tapes • Scissors • Storage tubs	Classroom / Field

	• Ensure health and safety standards	• Explain the selection criteria for greenhouse as per crop requirement (rabi and kharif) • Describe the procedures to maintain logbooks for keep record. • Explain the health and safety measures as per requirements. **<u>Practical Activity:</u>** Design greenhouse structure on chart.			
LU2. Prepare for installation of greenhouse	**Trainee will be able to:** • Ensure safety equipment as per standard SOPs • Identify and arrange required tools for installation • Prepare installation site as per	• Explain the main steps involved in installation of greenhouse (Step 1:Select a design Step 2:Select a location and direction Step 3: Gather the required material Step 4:Build the foundation Step 5:Framing the front and back	**Theory-** 2 Hrs **Practical-** 8 Hrs **Total-** 10 Hrs	• Pencil • Eraser • Sharpener • Calculator • Computer unit & internet • Markers • Tapes • Drawing	Classroom / Field

	standard requirements • Ensure performance check of required instruments • Prepare layout for required greenhouse as per standard criteria	Step 6: Framing the sides Step 7:Raising the walls Step 8: Installing greenhouse roof Step 9:Finish the exterior Step 10:Install temperature and humidity control system). • Enlist the tool required for the working of greenhouse (heaters, fans, vents & ventilators, light bulbs, irrigation equipment's, humidity controllers, pots, trays, thermometers, carts, wagons, raised bed, kits, doors, aluminum extrusions, alarms & monitors, monitoring meters, water storage tanks and reservoirs etc.) • Enlist the irrigation methods used in greenhouse (mist and sprinkler, drip, hoes and connectors , hand water, pumps and valves, rainwater catch drains, capillary mats, brass siphon mixer, rainwater catch drains etc). • Discuss the calibration requirements of the		sheet • Measuring tape	

		systems. **<u>Practical Activity:</u>** Make a group of 5 students and prepare a layout for greenhouse installation			
LU3. Perform Installation of Lean-to type	**Trainee will be able to:** • Ensure availability of required installation tools and materials • Implement layout plan as per design • Perform installation of lean-to structure • Perform post installation practices as per standards • Ensure health and safety standards	• Define lean-to-type greenhouse. • Enlist the crops that can grow in lean to type greenhouse (tomatoes, peppers, cucumbers and aubergines) • Discuss the advantages of lean-to greenhouse (space, temperature, ease, appearance, makes gardening simple and cheap as compared to even-span) • Enlist the tools required to build lean-to greenhouse (safety gloves, glasses, miter saw, jigsaw, chalk line, measuring tape, spirit level, carpentry pencil, drill machine and drill bits) • Explain the building steps of lean-to type greenhouse (Building the side wall, building the tall side wall, assembling the frame, front wall plans, back wall plans, attaching	**Theory-** 2 Hrs **Practical-** 8 Hrs **Total-** 10 Hrs	• Pencil • Eraser • Sharpener • Calculator • Computer unit & internet • Notepads • Safety gloves, • Glasses, • Miter saw, • Jigsaw, • Chalk line, • Measuring • tape, • Spirit level, • Carpentry pencil, • Drill machine • Drill bits	Classroom / Field/ workplace

		and building the rafters, building the vents and attaching the door). • Discuss health and safety standards as per requirement. **Practical Activity:** Sketch and prepare the model of Lean-to type greenhouse.			
LU4. Perform Installation of Even Span type	**Trainee will be able to:** • Ensure availability of required installation tools and materials • Implement layout plan as per design • Perform installation of even span structure • Perform post installation practices as per standards • Ensure health and safety standards	• Define even-span type. • Enlist the crops that can grow in even span type greenhouse (lettuce, spinach, leafy green vegetables, carrots, summer crops and herbs) • Discuss the advantages of even- span type (greater design flexibility, provides more space to plants, better shape to maintain uniform temperatures during the winter heating season) • Explain the building steps of even span type greenhouse (End wall is attached to a	**Theory-** 2 Hrs **Practical-** 8 Hrs **Total-** 10 Hrs	• Pencil • Eraser • Sharpener • Calculator • Computer unit & internet • Notepads • Safety gloves, • Glasses, • Miter saw, • Jigsaw, • Chalk line, • measuring • tape, • Spirit level, • Carpentry	Classroom / Field/ workplace

		building, the two roof slopes are of equal pitch and width, rafters are equal length, and it is attached to a house at one gable end. It can accommodate 2 or 3 rows of plant benches. • Explain health and safety precautions as per requirement. **Practical Activity:** Sketch and prepare the model of even-span type of greenhouse.		pencil, • Drill machine • Drill bits	
LU5. Perform Installation Ridge and Furrow type	**Trainee will be able to:** • Ensure availability of required installation tools and materials • Implement layout plan as per design • Perform installation of ridge and furrow • Perform post installation practices as per standards	• Define ridge and furrow type greenhouse. • Discuss the advantages of ridge and furrow type greenhouse (space, temperature, ease, appearance, makes gardening simple and cheap as compared to even-span) • Explain the building steps of **r**idge and furrow type (The ridge and furrow configuration are applicable to most of the commercial style greenhouses having	**Theory-** 2 Hrs **Practical-** 8 Hrs **Total-** 10 Hrs	• Pencil • Eraser • Sharpener • Calculator • Computer unit & internet • Notepads • Safety gloves, • Glasses, • Miter saw, • Jigsaw, • Chalk line,	Classroom / Field/ workplace

	• Ensure health and safety standards	single large interior, Consolidation of inte rior space reduces labour lowers the cost of automation, improves personal management and reduces fuel consumption as there is less exposed wall area through which heat escapes) • Enlist the crops that can grow in **r**idge and furrow type of greenhouse (Floriculture and vegetable production). • Discuss health and safety measures. **<u>Practical Activity:</u>** Sketch and prepare the model of **r**idge and furrow type greenhouse.		• measuring tape, • Spirit level, • Carpentry pencil, • Drill machine • Drill bits	
LU6. Perform Installation Gothic arch type	**Trainee will be able to:** • Ensure availability of required installation tools and materials • Implement layout plan as per design • Perform installation of Gothic arch	• Define Gothic arch type. • Enlist the crops that can grow in Gothic arch type (sprouts, radish, green onion, lettuce, peas, bush green, summer squash and broccoli etc) • Discuss the advantages of Gothic arch type (Simple and efficient shape, design	**Theory-** 2 Hrs **Practical-** 8Hrs **Total-** 10 Hrs	• Pencil • Eraser • Sharpener • Calculator • Computer unit & internet • Notepads • Safety gloves, • Glasses,	Classroom / Field/ workplace

	• Perform post installation practices as per standards • Ensure health and safety standards.	allows for easy water and snow runoff, plastic sheeting reduces the design cost, conserves heat). • Explain the building steps of Gothic arch type (the arched roof of this greenhouse eliminates the need for structural trusses. it has a double layer of polyethylene covering). • Discuss health and safety precautions. **Practical Activity:** Sketch and prepare the model of gothic arch type greenhouse.		• Miter saw, • Jigsaw, • Chalk line, • measuring tape, • Spirit level, • Carpentry pencil, • Drill machine • Drill bits	
LU7. Perform Installation of Quonset type	**Trainee will be able to:** • Ensure availability of required installation tools and materials • Implement layout plan as per design • Perform installation of Quonset • Perform post installation practices	• Define Quonset type greenhouse. • Enlist the crops that can grow in Quonset type greenhouse (lettuce or strawberries) • Discuss the advantages of Quonset type greenhouse (well on hillsides and maximizes heating from the sun. • Explain the building steps of Quonset type greenhouse (curved roof with military hut-	**Theory-** 2 Hrs **Practical-** 7 Hrs **Total-** 9 Hrs	• Pencil • Eraser • Sharpener • Calculator • Computer unit & internet • Notepads • Safety gloves, • Glasses, • Miter saw,	Classroom / Field/ workplace

	as per standards • Ensure health and safety standards	style design, made of aluminum or PVC pipes, glazed with a polyethylene film or panels for insulation, plastic film is stretched across a series of metal hoops). • Maintain personnel hygiene conditions for work place. **Practical Activity:** Sketch and prepare the model of Quonset type greenhouse.		• Jigsaw, • Chalk line, • measuring • tape, • Spirit level, • Carpentry pencil, • Drill machine • Drill bits	
LU8. Perform Installation of Cold frame type	**Trainee will be able to:** • Ensure availability of required installation tools and materials • Implement layout plan as per design • Perform installation of Cold frame • Perform post installation practices as per standards • Ensure health and safety standards	• Define Cold frame type • Discuss the part of cold frame (**Top** – A light-permeable cover such as glass, plexiglass, or greenhouse plastic is used for the top of a cold frame. • **Sides** – The sides are made of any material that will create a supportive structure for the cover. • **Bottom** – A bottom is not necessary for cold frame. Mostly soil is used. If you decide to create a base for your cold	**Theory-** 3 Hrs **Practical-** 8 Hrs **Total-** 11 Hrs	• Pencil • Eraser • Sharpener • Computer unit & internet • Notepads • Safety gloves, • Glasses, • Chalk line, • Measuring tape, • wooden boxes • plastic	Classroom / Field/ workplace

		frame, make sure it allows water to drain) • Explain the types of cold frame (Traditional brick built cold frame, the wooden sided cold frame, the aluminum and glass cold frame and twin walled plastic cold frames) • Discuss the benefits of Cold frame type greenhouse (Prolong the growing season to harvest greens and cool-season vegetables in winter, cold frames create a microclimate, protect plants from wind and rains during stormy months). • Explain the construction material required for Cold frames (timber and plastic, concrete blocks or bricks, bottomless wooden box and set it in the garden or atop other good soil in a sunny location). • Explain the making of hot bed (Electric heating tape or cables and horse manure or compost) • Discuss health and safety standards as per		sheets • Nut bolts • Hammer	

		requirement. **Practical Activity:** • Sketch and prepare the model of Cold frame.			

Module 19. Maintain Greenhouse structure

Objective: After the completion of this module, the Trainee will be able to effectively maintain the greenhouse.

Duration: 20 Hours **Theory: 5 Hours** **Practical: 15 Hours** **Credit Hours: 2**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Monitor the greenhouse	**Trainee will be able to:** • Perform periodic surveys of the greenhouse • Identify structural damage • Report the structural damage as per standard format • Ensure health and safety standards	• Define greenhouse • Discuss manual monitoring system for greenhouse • Describe greenhouse monitoring conditions • Enlist monitor devices for greenhouse (Thermometer, hygrometer, moisture sensors, etc.) • Enlist tools required to prepare smart greenhouse (sensors, remote control, power source, etc.) • Define damaging factors of a greenhouse **<u>Practical Activity:</u>**	**Theory-** 2 Hrs **Practical-** 5 Hrs **Total-** 7 Hrs	• Ladder • Notebook • Pencil • Marker • Eraser • Sharpner • Measuring tape • Iron Rod • Tools	Classroom Lab/ Field Visit

		Prepare a report on identification and structural damage of a greenhouse			
LU2. Maintain greenhouse structure	**Trainee will be able to:** • Arrange required material and tools for repairing • Repair the required damage of greenhouse structures • Maintain records • Ensure health and safety standards	• Describe greenhouse structure • Explain greenhouse maintenance • Enlist materials and tools required for greenhouse maintenance • Describe management practices regarding greenhouse damages **Practical Activity:** Conduct a survey and prepare a report on factors affecting greenhouse	**Theory-** 3 Hrs **Practical-** 10 Hrs **Total-** 13 Hrs	• Ladder • Notebook • Pencil • Marker • Eraser • Sharpner • Measuring tape • Iron Rod • Tools	Class Room Lab/ Field Visit

Module 20. Operate greenhouse components

Objective: After the completion of this module, the Trainee will be able to understand the working of different components of Greenhouse for appropriate maintainace of required environment.

Duration: 6 Hours **Theory: 24 Hours** **Practical: 30 Hours** **Credit Hours: 3**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Assess working of various Greenhouse Components	**Trainee will be able to:** • Identify different types of greenhouses. • Identify suitability as per crop requirement. • Identify and arrange power source to fulfil energy requirements.	• Discuss different styles of greenhouse design • Discuss the best shape and size for a greenhouse • Knowledge of greenhouse selection according to the crop type **<u>Practical Activity:</u>** Prepare a report on selection of a greenhouse according to crop type	**Theory-** 1 Hrs **Practical-** 3 Hrs **Total-** 4 Hrs	• Stationery	Class Room Lab/ Field Visit

LU2. Operate environmental controlling components	**Trainee will be able to:** • Perform understanding of different equipment used for controlling microclimate. • perform measures to control Humidity in Greenhouse • Perform measures to control Temperature in the Greenhouse. • Ensure Hygienic conditions at the workplace.	• Define greenhouse components • Describe suitable environmental conditions inside greenhouse for crop growth • Explain the working protocol of greenhouse components • Knowledge about maintenance and functioning of greenhouse **<u>Practical Activity:</u>** Conduct a greenhouse visit to check its maintenance and proper functioning	**Theory-** 1 Hrs **Practical-** 7 Hrs **Total-** 8 Hrs	• Fans • Exhaust • Pads • Humidifier/fogger • Heater • Frame work • Plythene sheets • Motors • Water reservoir • Pumps • Fertilizer Mixer • Pipes including the main and laterals • Drips • Shading nets • Glass sheet	Class Room Lab/ Field Visit
LU3. Operate Processing Component	**Trainee will be able to:** • Perform identification of processing components of	• Explain greenhouse operation • Define processing and operating components of a greenhouse • Explain standard procedure to operate greenhouse	**Theory-** 2 Hrs **Practical-** 7 Hrs	• Fans • Exhaust • Pads • Humidifier/fogger • Heater • Frame work • Plythene sheets	Class Room Lab/ Field Visit

	Greenhouse • Perform operation of processing of components of Greenhouses. • Ensure PPEs and maintain hygienic conditions at workplace.	**Practical Activity:** Prepare a report on operating functions of a greenhouse	**Total-** 9 Hrs	• Motors • Water reservoir • Pumps • Fertilizer Mixer • Pipes including the main and laterals • Drips • Shading nets • Glass sheet	
LU4. Operate irrigation system	**Trainee will be able to:** • Perform Identification of irrigation systems as per conditions • Perform operation of irrigation types as per standard. • Ensure PPEs and maintain hygienic conditions at	• Define irrigation system • Describe irrigation process • Enlist different types of irrigation system (Overhead and subsurface systems) • Explain the best watering system for greenhouse • Discuss the working of irrigation system **Practical Activity:** Prepare a report on different type of irrigation systems and their working	**Theory-** 2 Hrs **Practical-** 7 Hrs **Total-** 9 Hrs	• Fans • Exhaust • Pads • Humidifier/fogger • Heater • Frame work • Plythene sheets • Motors • Water reservoir • Pumps • Fertilizer Mixer • Pipes including the main and laterals • Drips • Shading nets • Glass sheet	Class Room Lab/ Field Visit

	workplace.				

Module: 21 Perform greenhouse Operations

Objective: After completion this module ,the Trainee will be able to understand working of different components of Greenhouse for appropriate maintainace of required environment.

Duration: 20 Hours **Theory: 05 Hours** **Practice: 15 Hours** **Credit Hours: 2**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1 Collect planting material	**Trainee will be able to;** • Identify the planting material as per requirement and maintain its record. • Ensure collection of concerned plant material on time. • Perform labelling as per required format. • Ensure personnel hygiene and work place sanitation	• Enlist the tools for plant collection (clippers, digger etc). • Explain plant sampling methods • Define germplasm • State types of germplasm collection (base, back-up, active and breeders' or working collections) • Define crop scheduling • Explain labelling protocols for collected plant samples	**Theory-** 01 Hrs **Practical-** 3 Hrs **Total-** 4 Hrs	• Notebook • Pen • Pencil • Logbooks • Labels	Class Room Training Workshop

	according to required set standard.	• Explain personnel hygiene and sanitation protocols as per recommendations **Practical Activity:** Prepare a report on different planting materials			
LU2. Prepare media for plantation	• Perform identification of different types of media • Ensure suitable selection of growing media as per requirement. • Perform labelling as per required format. • Ensure personnel hygiene and work place sanitation according to required set standard	• Define plant growth media • Define types of growing media • Define growing media components (organic and inorganic) • Enlist plant growth materials (peat, coir pith, wood fibers, bark, green waste,	**Theory-** 02 Hrs **Practical-** 4 Hrs **Total-** 6 Hrs	• Notebook • Pen • Pencil • Logbooks • Labels	Class Room Training Workshop

		perlite, pumice, clay and vermiculite) • Define characteristics of a good growing media • Explain greenhouse management practices **<u>Practical Activity:</u>** Make a group of two students and prepare different plant growth media			
LU3. Perform management operations	• Identification of management operations as per requirement • Implementation of	• Enlist management operations in greenhouse • Discuss standards	**Theory-** 01 Hrs **Practical-** 4 Hrs **Total-** 5 Hrs	• Notebook • Pen • Pencil • Logbooks • Labels	

	management practices as per standards • Ensure personnel hygiene and work place sanitation according to required set standard	for implementation of operations in greenhouse • State the personal hygiene and sanitation procedures as per requirement **Practical Activity:** Make a group of 5 students and perform management operations in greenhouse.			
LU4 Maintain Records	• Prepare stock control system of equipment as per requirements • Identify ordering system and process as per standard • Ensure stock level as per requirement • Ensure safe placement of records	• Define plant inventory • Discuss management of stock control • Define record management practices **Practical Activity:**	**Theory-** 01 Hrs **Practical-** 4 Hrs **Total-** 5 Hrs	• Notebook • Pen • Pencil • Logbooks • Labels	

		Prepare a report on available stock in inventory			

Module: 22. Perform Integrated pest management (IPM)

Objective: After the completion of this module, the Trainee will be able to identify pest and implement control strategies by Integrated pest management (IPM).

Duration: 70 Hours **Theory: 16 Hours** **Practice: 54 Hours** **Credit Hours: 7**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Identify pest invasion	**Trainee will be able to:** • Identify plant pest and disorders according to prescribed IPM standard. • Identify the beneficial organism • Assess scope and size of damage according to economic threshold level (ETL)	• Define plant pest. • Enlist plant pests (Fungi, bacteria, viruses, caterpillars, moths, beetles, thrips, mites, nematodes, and weeds etc.) • Enlist the sampling techniques (Absolute and relative) • Discuss sampling methods • Define beneficial organism • Enlist beneficial organism • Define scouting	**Theory-**2 Hrs **Practical-** 5 Hrs **Total-** 7 Hrs	• Pencil • Eraser • Notebook • Chart • Collection box • Mask • Safety kits • Forceps • Gloves • plastic bags • Poison bottle • Ariel nets • Labels & tags • Insect traps	Classroom/ Lab/ Field Visit

	• Follow health and safety standard required	• Define ETL • Discuss ETL to assess damage by insects • Explain IPM strategies • Explain health and safety precautions as per requirement. **<u>Practical Activity:</u>** Conduct a field visit to collect insects and prepare a scouting report			
LU2. Schedule the implementation of control strategies by IPM	**Trainee will be able to:** • Select required control activities according to damage. • Identify and arrange tools, equipment's, machinery, and biological cards for required activity • Ensure Risks and hazards management according to safety standards.	• Define pest monitoring. • Define pest surveillance • Enlist the three basic components and objectives of pest surveillance • Define pest forecasting and its types (short- and long-term forecasting). • Enlist the five key components of IPM (prevention, monitoring, diagnose, planning and management). • Discuss sticky cards for flying insects	**Theory-** 2Hrs **Practical-** 8 Hrs **Total-** 10 Hrs	• Pencil • Eraser • Notebook • Charts • Mask • Markers • Gloves • plastic bags • Poison bottle • Ariel nets • Labels & tags • Insect traps • First aid box	Classroom/ Lab/ Field Visit

	• Ensure Personal Protective Equipment (PPE) according to required operations. • Ensure Eco-friendly procedures according to standards	(Whiteflies, thrips, leaf miners, and winged aphids. Mites, mealybugs, scale insect, and aphids etc.) • Enlist the control activities involved in IPM (chemical ,biological physical and cultural practices). • Knowledge about PPE's according to required operation **Practical Activity:** Conduct field visit to identify the most appropriate control strategy according to the crop.			
LU3 Perform Biological control	• Perform identification for effectiveness of biological control agents • Perform application of biological control agents as per recommendations • Periodic inspection for its effeteness • Make visits and evaluate	• Define biocontrol method. • Define biological control agent(BCA) • Enlist some examples of biocontrol agents • Discuss the application methods of BCA's according to the type of biological agent.	**Theory-** 2Hrs **Practical-** 8 Hrs **Total-** 10 Hrs	• Pencil • Eraser • Notebook • Charts • Mask • Markers • Gloves • plastic bags • collection	Classroom / Lab/ Field Visit

	results. • Ensure health and safety standards	• Discuss report format for evaluating effectiveness of BCA's. • Explain standards for health and safety measures **Practical Activity:** Conduct a field visit to observe the activity of biocontrol agent in crop.		bags • Poison bottle • Ariel nets • Labels & tags • First aid box • Medias(for fungal and bacterial growth) • Autoclave • Petri plates • Microscopes	
LU4 Perform Physical control	• Perform identification for effectiveness of Physical control agents. • Perform application of Physical control agents as per recommendations. • Periodic inspection for its effeteness. • Make visits and physical evaluate results.	• Define physical control • Enlist different physical control methods • Explain the procedure of physical control • Discuss report format for analyze physical control • Describe personal health and safety precautions as per requirement. **Practical Activity:** Make a group of five students and perform	**Theory-** 2Hrs **Practical-** 7 Hs **Total-** 9Hrs	• Pencil • Eraser • Notebook • Charts • Mask • Markers • Gloves • Labels & tags • Plastic sheets • Plastic bags • sticky cards • First aid box	Class Room Training Workshop Lab/ Field Visit

	• Follow health and safety standards	physical control in greenhouse.			
LU5 Perform Cultural control	• Perform identification for effectiveness of Physical control agents. • Perform identification and arrange Cultural control tools • Perform Physical control agents as per recommendations. • Periodic inspection for its effectiveness. • Make visits and evaluate results. • Ensure PPEs.	• Define cultural control measures. • Enlist different types of cultural control implements • Explain different cultural control methods. • Discuss report format to analyze cultural control practices. • Describe health and safety measures as per activity. **Practical Activity:** Make a group of five students and perform cultural control.	**Theory-** 3 Hrs **Practical-** 8 Hrs **Total-** 11 Hrs	• Pencil • Eraser • Notebook • Charts • Mask • Markers • Gloves • Labels & tags • Plastic sheets • Plastic bags • sticky cards • First aid box • Safety goggles • Irrigation nozzles • pruning shears • Brooms • pH strips	Class Room Lab / Field Visit

LU6 Perform Chemical control	• Perform identification for effectiveness of Chemical control agents. • Perform identification and arrange chemicals (pesticides) • Perform application of Chemical (pesticides) as per recommendations. • Periodic inspection for its effectiveness. • Make visits and evaluate results. • Ensure PPEs	• Define chemical control • Define active ingredient. • Explain the different types of chemicals (insecticides, herbicides, fungicides, bactericides, weedicides etc) • Discuss the methods use for pesticide application (aerial, soil mixing etc). • Enlist different types of nozzles used for application of pesticides • Discuss the precautionary requirements for application of chemicals. • Knowledge of pesticide labels. • Describe the protocol for proper storage and disposal of chemicals. • Discuss the proper use of PPEs. • Explain the guidelines for keeping pesticide records (used, application rates, timing and whether conditions). **Practical Activity:**	**Theory-** 3 Hrs **Practical-** 8Hrs **Total-** 11 Hrs	• Pencil • Eraser • Notebook • Charts • Mask • Markers • Gloves • Labels & tags • Goggles • Masks • Nozzles • Plastic sheets • Plastic bags • First aid box • Coverall • Respirator • Boots • Aprons • Safety racks • Containers • weigh balance • Beakers	Classroom Lab/ Field Visit

		Prepare an assignment on chemical labels and enlist the precautionary measures.			
LU7 Perform pest control measures	• Identify and arrange required tools and chemicals required to perform IPM activity • Implement IPM standards. • Maintain workplace after completion of each activity. • Prepare performance report according to format. • Maintain record according to legislative guidelines	• State the main for steps involved in IPM • Discuss performance of IPM activities. • Explain the protocols for workplace after implementation of IPM strategy. • Explain the IPM logbooks (inspection, sheets, pest logs, dates, maps and previous activities.) • Explain the legislative standards for IPM strategies. • **Practical Activity:** Assign student to prepare logbooks for IPM activities (physical, cultural, biological and chemical)	**Theory-** 1Hrs **Practical-** 5 Hrs **Total-** 6 Hrs	• Pencil • Eraser • Sharpener • Calculator • Computer unit & internet • Logbooks • Maps	Class Room Training Workshop Lab/ Field Visit

LU8 Inspect Control measures	• Check side effects of control measures on plants and external environment. • Measure efficiency of applied control activity with reference to standard protocols. • Regulate IPM control methods to meet organizational requisites	• Enlist the main goals of IPM (Prevent environmental risks and mitigate environmental risks that cannot be prevented). • Discuss the ecological impacts of IPM strategies on plants and environment. • Describe the regulatory measures of IPM with reference to organizational requirement. **Practical Activity:** Make a model for IPM control strategies.	**Theory-** 1Hrs **Practical-** 5Hrs **Total-** 6Hrs	• Pencil • Eraser • Sharpener • Calculator • Computer unit & internet • Logbooks • Maps	Classroom Lab/ Field Visit

11. List of Tool & Equipment:

As mentioned in **'Materials required'** column

12. Members of the Curriculum Development Committee

S#	Name	Designation
1	Dr. Adnan Zahid	Associate Prof (IAGS,PU, Lahore)
2	Dr. Sumaira Maqsood	Associate Prof (IAGS,PU, Lahore)
3	Ms. Noor ul Ain	M.Phil. Scholar, (IAGS,PU, Lahore)
4	Ms. Hina Ashraf	PhD Scholar (PU, Lahore)
5	Mr. Muhammad Faheem	RA, Arid University Rawalpindi
6	Mr. Muhammad Asif	Master Trainer, off Seasonal Vegetables Lahore

7	Syeda Tehmeen Fatima	M.Phil. Scholar, (IAGS,PU, Lahore)
8	Abdul Manan Saleem	PhD Scholar
9	Ms. Sana GulDad	Agriculture Department KPK
10	Mr. Farhan Mehmood	Parks and Horticulture Authority, Rawalpindi
11	Ms. Iqra Haider Khan	IAGS,PU, Lahore
12	Ms, Hadia Maqsood	IAGS,PU, Lahore
13	Muhammad Abdul Basit	R&D Manager, Lahore
14	Engr. Aijaz Ahmed Zia	DACUM Facilitator

15	Mr. Muhammad Ishaq	Deputy Director/ Coordinator – (Skills Standards and Curricula) NAVTTC HQ