FEDERAL MINISTRY OF EDUCATION

National Technical Certificate (NTC) Curriculum in

SMART AGRICULTURAL CRAFT PRACTICE

February, 2025

NBTE

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THE WORLD BANK

Innovation Development and Effectiveness in the Acquisition of Skills (IDEAS) Project

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NATIONAL BOARD FOR TECHNICAL EDUCATION
Plot B, Bida Road, P.M.B. 2239, Kaduna, Nigeria

NATIONAL TECHNICAL CERTIFICATE

CURRICULUM AND MOUDULE SPECIFICATIONS IN

SMART AGRICULTURAL CRAFT PRACTICE

2025

GENERAL INFORMATION

AIM
To give training and impart the necessary skills leading to the production of skilled personnel that can fit into the Agricultural sector as craftsmen and self-reliant entrepreneurs.

ENTRY QUALIFICATIONS
Craft Programme
Candidates must not be less than 14 years of age and should have successfully completed three years of Junior Secondary education or its equivalent. Special consideration may be given to candidates with lower academic qualifications who hold trade test certificate and are capable of benefiting from the programme.

The Curriculum
The Curriculum of each programme is broadly divided into three components:

1. **Curriculum Structure**: Courses are determined according to how or what knowledge is expected to provide the students with:
    a. General Education - The General Education component which accounts for 30% of the total hours required for the programme aims at providing the trainee with complete secondary education in critical subjects like English Language, Mathematics, Economics, Physics, Chemistry. Agricultural science and Biology, to enhance the understanding of machines, tools and materials of their trades and application and as a foundation for post-secondary technical education for the above average trainee.
    b. Trade Subjects- These are subjects which account for 65% of the total hours required for the programme and teach the basic concepts preparatory to learning major skills in the discipline being pursued. They provide introductory parameters leading to understanding the major ideas in the field. At the second and third year the trade subjects provide the basic and core skills required to function at the level of craftsman and artisan.
    c. Supervised Industrial Training/Work Experience- This accounts for 5% of the total hours required for the programme exposes the trainee to the core competencies and skills required for graduation in his chosen area. This component of the course may be taken in industry or in the college production unit.

Included in the curriculum are the teacher□s activities and learning resources required for the guidance of the teacher.
Unit Cours/Module

A course/ module is defined as a body of knowledge and skills capable of being utilized on its own or as a foundation or pre-requisite knowledge for more advanced work in the same or other fields of study. Each trade course/ module when successfully completed can be used for employment purposes.

Behavioural Objectives
These are educational objectives, which identify precisely the type of behaviour a student should exhibit at the end of a course/module or programme. Two types of behavioural objectives have been used in the curriculum. They are:

a. General Objectives
b. Specific Learning Outcomes

General objectives are concise but general statements of the behavior of the students on completion of a unit of week such as understanding the principles and application of smart technology in:
Crop production
Livestock production
Fish production
Processing and storage

General Education in Technical Colleges
The General Education component of the curriculum aims at providing the trainee with knowledge in critical subjects like English Language, Agriculture, Economics, Physics, Chemistry, Biology, Entrepreneurial Studies and Mathematics, etc. to enhance the understanding of machines, tools and materials of their trades and their application as a foundation for post-secondary technical education for the above average trainee. Hence, it is hoped that trainees who successfully complete their trade and general education may be able to compete with their secondary school counterparts for direct entry into Universities, Polytechnics or Colleges of Education (Technical) for degree, ND or NCE courses respectively.

National Certification
The NTC and ANTC programmes are run by Technical Colleges accredited by N.B.T.E.
NABTEB conducts the final nnational examination and awards certificates.
Trainees who successfully complete all the courses/ modules specified in the curriculum table and passed the national examinations in the trade will be awarded one of the following certificates:

S/NO	LEVEL	CERTIFICATE
	Technical Programme	
1.	NTC	National Technical Certificate

GUIDANCE NOTES FOR TEACHER IMPLEMENTING THE CURRICULUM
The number of hours stated in the curriculum table may be increased or decreased to suit individual institutions timetable provided the entire course content is properly covered and goals and objectives of each module are achieved at the end of the term.
The maximum duration of any module in the new scheme is 300 hours. This means that for a term of 15 weeks, the course should be offered for 20 hours a week. This can be scheduled in sessions of 4 hours in a day leaving the remaining hours for general education. However, properly organized and if there are adequate resources, most of these courses can be offered in two sessions a day, one in the morning and the other one in the afternoon. In so doing, some of these programmes may be completed in lesser number of years than at present.
The sessions of 4 hours include the trade theory and practice. It is left to the teacher to decide when the class should be held in the workshop or in a lecture room.

INTEGRATED APPROACH IN THE TEACHING OF TRADE
Theory, Trade Science and Trade Calculation
The traditional approach of teaching trade science and trade calculation as separate and distinct subjects in Technical College programmes is not relevant to the new programme as it will amount to a duplication of the teaching of mathematics and physical science subjects in the course. The basic concepts and principles in mathematics and physical science are the same as in the trade calculation and trade science. In the new scheme therefore, qualified persons in these fields will teach mathematics and physical science and the instructors will apply the principles and concepts in solving trade science and calculation problems in the trade theory classes. To this end, efforts have been made to ensure that mathematics and science modules required to be able to solve technical problems were taken as pre-requisite

EVALUATION OF PROGRAMME/MODULE
For the programme to achieve its objectives, any course started at the beginning of a term must terminate at the end of the term.
Instructors should therefore device methods of accurately assessing the trainees to enable them give the student s final grades at the end of the term. A national examination will be taken by all students who have successfully completed their modules. The final award will be based on the aggregate of the scores attained in the course work and the national examination

Contents

CURRICULUM TABLE AND COURSE HOURS/WEEK
PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN SMART AGRICULTURE

Module Code	MODULE	YEAR I						YEAR 2						YEAR 3						TOTAL HOURS
		Term 1		Term 2		Term 3		Term 1		Term 2		Term3		Term 1		Term 2		Term 3		
		T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	
	Mathematics																			
	English																			
	Chemistry																			
	Physics																			
	Agric																			
	Biology																			
CSA 111	Introduction to Smart Agriculture	2	2																-	
CSA 112	Smart Micro livestock Production	2	2																	
CSA 113	Principle of Smart Crop Protection	2	2																	
CSA 121	Smart Nursery and Greenhouse Technology	-	-	2	2															
CSA 122	Smart Agriculture Farming systems	-	-	2	2															
CSA 131	Smart Poultry Production	-	-	-	-	2	2													
CSA 132	Principles of Smart Irrigation Farming	-	-			2	2													
CSA 133	Smart Industrial Crop Production	-	-	-	-	2	2													
CSA 211	smart annual and industrial crop production							2	2											

CSA 212	Introduction to Smart Fish Production					-	-	2	2			-	-	-	-	-	-	-	-	
CSA 213	Principles of Smart Sheep, Goat and Swine Production	-	-	-	-	-	-	2	2			-	-	-	-	-	-	-	-	
CSA 221	Introduction to Entrepreneurship	-	-	-	-	-	-	-		2	2			-	-	-	-	-	-	
CSA 222	Introduction to Smart Animal Health	-	-	-	-	-	-	-	-	2	2			-	-	-	-	-	-	
CSA 223	Smart Soil Management	-	-	-	-	-	-	-	-	2	2	-	-							
CSA 232	Introduction to Farm Management											2	2							
CSA 312	Introduction to Smart Agricultural Extension	-	-	-	-	-	-	-	-	-	-	-	-	2	2					
CSA 331	Smart Agricultural marketing																	2	2	

NATIONAL TECHNICAL CERTIFICATE IN SMART AGRICULTURE CRAFT

<table>
<tr><td colspan="4">PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN SMART AGRICULTURE CRAFT PRACTICE</td></tr>
<tr><td colspan="2">MODULE: INTRODUCTION TO SMART AGRICULTURE</td><td>COURSE CODE: CSA 111</td><td>CONTACT HOURS: 4</td></tr>
<tr><td>YEAR: 1</td><td>TERM: 1</td><td>PRE: REQUISITE:</td><td>Theoretical: 2 Hours
Practical: 2 Hours</td></tr>
<tr><td colspan="4">GOAL: This module is designed to introduce the trainee to the principles and practices of smart of agriculture</td></tr>
<tr><td colspan="4">GENERAL OBJECTIVES:
On completion of this module, the trainee should be able to:
1.0 Outline the Scope of Smart Agriculture
2.0 Outline the Objectives of Smart Agriculture
3.0 Understand the Principles of Smart Agriculture
4.0 Understand the Importance and limitations of Smart Agriculture
5.0 Understand the Technologies Used/Adopted in Smart Agriculture
6.0 Understand Smart Agriculture Strategies
7.0. Understand the difference between smart agriculture and convectional/traditional agriculture</td></tr>
</table>

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN SMART AGRICULTURE CRAFT PRACTICE						
MODULE: INTRODUCTION TO SMART AGRICULTURE				**COURSE CODE: CSA 111**		**CONTACT HOURS:**
YEAR: 1	**TERM:** 1	**PRE: REQUISITE:**	**Theoretical:** 36 Hours **Practical:** 48 Hours			
GOAL: This module is designed to introduce the trainee to the principles and practices of smart agriculture						
Theoretical Content				**Practical Content**		
GENERAL OBJECTIVE 1.0: Outline the Scope of Smart Agriculture						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
1	1.1 Define Smart Agriculture 1.2. Explain the scope of Smart Agriculture 1.3. Outline the challenges of smart agriculture	Explain Smart Agriculture Explain the Scope of Smart Agriculture that distinguishes it from conventional agricultural practices: Precision Farming, Crop and Livestock Monitoring, Automated Machinery and Robotics, Climate-Smart Agriculture, Sustainable Resource Management, Soil Health and Nutrient Management, Urban and Vertical Farming, Data-Driven Farm Management	Chalk or magic board, cardboard drawings etc			

		Systems, etc. Outline the challenges of smart agriculture				
GENERAL OBJECTIVE 2.0: Outline the Objectives of Smart Agriculture						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
2	2.1 List the objectives of Smart Agriculture 2.2 Explain the application of smart agriculture in crop production	Explain the Objectives of Smart Agriculture: • Increase Yields, • Improve Resource Efficiency, Efficient farm management, Reduce Environmental Impact, reduces overall operational costs, Monitor Crop Health, Adapt to Climate Change, Explain the application of smart agriculture in crop production				
GENERAL OBJECTIVE 3.0: Understand the principles of smart agriculture						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
3-4	3.1 Explain the principle of smart agriculture	Describe the key principles of smart agriculture such as;	Chalk or magic board, cardboard	visit a smart agriculture enterprise	Accompanying the students on a visit to a smart	

	3.2 List the principles of smart agriculture	• Data-Driven Decision Making, • Precision Farming, • Environmental sustainability, • Integration of Internet of Things (IoT), • Automation and Robotics, • Continuous monitoring and early detection systems for pests and diseases, • Integration of Artificial Intelligence (AI) and Machine Learning (ML), • waste reduction and creation of circular economy.	drawings etc		agriculture enterprise	
GENERAL OBJECTIVE 4.0: Understand the Importance and limitations of Smart Agriculture						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
5	4.1 Explain the importance of smart agriculture 4.2 Explain the application of smart agriculture 4.3 Outline the limitations of smart agriculture	Discuss the importance of smart agriculture Explain the limitations of smart agriculture	Chalk or magic board, cardboard drawings etc			

GENERAL OBJECTIVE 5.0: understand technologies used in smart agriculture						
6-8	5.1 List the technologies used in Smart Agriculture 5.2 Explain the Technologies Used in Smart Agriculture:	Explain the application of key technologies used in smart agriculture • Geographic Information Systems (GIS) • Blockchain Technology, • Robotics and automation • Artificial Intelligence (AI) and Machine Learning (ML), • Drones and UAVs (Unmanned Aerial Vehicles, • Internet of Things (IoT) • Cloud Computing, • Vertical Farming Technologies, • Automated irrigation systems	Chalk or magic board, cardboard drawings etc	Identify the various technologies used in smart agriculture Demonstrate the application of technologies in smart agriculture Visit a farm or research institute	Guide student to: Identify the various technologies used in smart agriculture Demonstrate the application of technologies in smart agriculture Visit a farm or research institute	Computers, IoT devices, GPS, GIS, Soil sensors
GENERAL OBJECTIVE 6.0: Understand smart agriculture strategy						
8-9	6.1 List the strategies of smart agriculture 6.2 Explain smart agriculture strategy such as:	Explain the strategies of smart agriculture Explain smart	Chalk or magic board, cardboard drawings etc			

		agriculture strategy such as: • Rotational grazing • Specialized feed formulation • Manure management using variable rate technology (VRT) • smart irrigation systems • -Incorporate renewable energy sources • Regular evaluation of adopted technologies				
GENERAL OBJECTIVE 7.0: Understand the difference between smart agriculture and conventional agriculture						
10	7.1 List the difference between smart agriculture and convectional/traditional agriculture 7.2 Explain difference between smart agriculture and convectional/traditional agriculture	Outline the difference between smart agriculture and conventional/traditional agriculture	Chalk or magic board, cardboard drawings etc	Identify the difference between the two	Guide student to watch videos of smart agriculture enterprise and convectional farm to identify the difference between the two.	Computer Cell phone Audio visual material

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN SMART AGRICULTURE				
COURSE: INTRODUCTION TO SMART MICRO LIVESTOCK PRODUCTION			**COURSE CODE: CSA 112**	**TOTAL HOURS:**
YEAR: 1	**TERM:** 1	**PRE: REQUISITE:**	**THEORETICAL: 2** **PRACTICALS: 2**	
GOAL: The course is design to provide Students with basic knowledge of principles, practice of production in Smart micro livestock				
General Objectives: On completion of this course the students should be able to: 1.0 Know the species of animals regarded as Micro livestock species 2.0 Know the types of housing and equipment required for micro livestock production 3.0 Understand the Smart nutrition and feeding of micro livestock 4.0 Understand the smart routine management of different species of micro livestock 5.0 Know the common disease of micro livestock animals and their control				

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN SMART AGRICULTURE						
MODULE: INTRODUCTION TO SMART MICRO LIVESTOCK PRODUCTION				**COURSE CODE: CSA 112**		**CONTACT HOURS:**
YEAR: 1	**TERM:** 1	**PRE: REQUISITE:**		**Theoretical: 2**		
GOAL: The course is design to provide Students with basic knowledge, principles and practice of production in Smart micro □ livestock						
Theoretical Content				**Practical Content**		
GENERAL OBJECTIVE 1.0: Know the species of animals regarded as Micro □ livestock species						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
1	1.1 Define the term Micro □ Livestock 1.2 Mention different species of Micro □ Livestock	Explain the term Micro □ Livestock Explain different species of Micro □ Livestock • Rabbit • Quails • Pigeons • Edible land Snails • Grass Cutter • Guinea Pigs	Teaching aids Multimedia White board	Identify the different species of Micro-livestock Visit a live stock farm	Guide students to identify the different species of micro live stock Visit a live stock farm	Micro-livestock species - Hutches - Deep litter - Books Livestock manager □ (Mobile App)
	1.3 Explain the importance of rearing Micro □ livestock species under smart agriculture	Explain the importance of rearing Micro □ livestock species under smart agriculture	Teaching aids Illustration White board Multimedia Lecture note			-
GENERAL OBJECTIVE2.0: Know the types of housing and equipment required for Micro □ livestock production						
			Sample	Describe typical		Visit micro-

	2.1Mention different terminologies for various micro- Livestock housing 2.2 Describe various types of micro-Livestock housing 2.3 State spacing requirements for various micro- Livestock 2.4 Explain importance of housing for micro- livestock 2.5 List bedding materials needed in different micro-livestock housing	Explain the various terminologies • nestling • hutches • meshes •aviary •boxes •greenhouse • perches Describe the materials •Sand •woodshavings • wet/moist leaves or floors	drawings Sample construction equipment • wires • wood • nets	micro-livestock housing	Guide students to identify the different types of housing for micro-livestock	livestock farm •snailery •aviary •rabbitory Meter rule
	2.6 Mention different types of equipment for micro-livestock farming 2.7 Describe the types of equipment for micro-livestock farming 2.8 Mention other facilities in different micro-livestock equipment	Describe vividly each equipment for snails, rabbits, grasscutter (drinkers, feeders, foggers , sippers etc) Explain equipment • leisure (eg, swings) •nursery box • egg incubation tray	Pictures Internet Chalkboard Sample pictures Multimedia	Explain equipments Show how to construct equipment	Can construct the equipments Identify the various equipment	Visit Farms Equipment construction sheds Equipment sales points

<table>
<tr><td colspan="4">PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN SMART AGRICULTURE CRAFT PRACTICE</td></tr>
<tr><td colspan="2">MODULE: PRINCIPLES OF SMART CROP PROTECTION</td><td>COURSE CODE: CSA 113</td><td>CONTACT HOURS:</td></tr>
<tr><td>YEAR: 1</td><td>TERM: 1</td><td>PRE: REQUISITE:</td><td>Theoretical: 36 Hours
Practical: 48 Hours</td></tr>
<tr><td colspan="4">GOAL: This module is designed to introduce the trainee to the basic smart knowledge of crop diseases, pests, and method of control</td></tr>
<tr><td colspan="4">GENERAL OBJECTIVES:

On completion of this module, the trainee should be able to:

1.0 Understand the general principles of crop protection using smart technology.
2.0 Understand the application of smart technology in identifying plant diseases and methods of control.
3.0 Understand the application of smart technology in identifying insect, pests and methods of control.
4.0 Understand the application of smart technology in identifying weeds and methods of control.
5.0 Understand the application of smart technology in identifying nematode, pests and methods of control.
6.0 Understand the application of smart technology in identifying vertebrate, pests and methods of control</td></tr>
</table>

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN IN SMART AGRICULTURE CRAFT PRACTICE						
MODULE:				**COURSE CODE:**		**CONTACT HOURS:**
YEAR: 1	**TERM:** 1	**PRE: REQUISITE:**		**Theoretical:** 36 Hours **Practical:** 48 Hours		
GOAL: This module is designed to introduce the trainee to the basic smart knowledge of crop diseases, pests, and method of control.						
Theoretical Content				**Practical Content**		
GENERAL OBJECTIVE 1.0 Understand the general principles of crop protection using smart technology						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
1	1.1 Define crop protection in smart agriculture 1.2 Outline the importance of crop protection in smart agriculture 1.3 Explain the importance of crop protection in smart agriculture 1.4 Outline the challenges of crop protection in smart agriculture	Explain crop protection in smart agriculture Explain the importance of crop protection in smart agriculture Discuss the importance of crop protection in smart agriculture Explain the challenges of crop protection in smart agriculture	LCD Projector, slide projector, white board, markers, laptop computers.			

GENERAL OBJECTIVE 2.0: Understand the application of smart technology to identify plant diseases and methods of control						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
1	2.1 Define the term disease in relation to crops 2.2 Explain the common diseases of crops 2.3 Explain the effect and symptoms of disease listed in 2.2 2.4 Describe the methods of control of diseases in 2.2 2.5 Describe the use of smart technology to detect diseases in 2.2	Explain the term disease in relation to crops . Discuss the common diseases of crops Explain the effect and symptoms of disease listed in 2.2 above. Describe the methods of control of diseases in 2.2 above. Discuss the usage of smart technology to detect diseases in 2.2 above.	LCD Projector, slide projector, white board, markers, laptop computers, pictures of diseased plants	Identify common diseases in 2.2 Use smart technology to detect diseases in 2.2	Guide student to: Visit a crop farm to Identify common diseases in 2.2 Watch videos to identify diseases Use smart technology to detect diseases in 2.2	Audio visual Microscope Slides Diseased plants, Magnifying Lens, smart technology sensors, apps,. Plant disease samples
GENERAL OBJECTIVE 3.0: Understand the application of smart technology to identify insects, pests and their methods of control						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
5	3.1 Explain different insects, pests and the plants they damage using smart technology 3.2 **Describe** the nature of damage caused by insect, pests to crops 3.3 Explain the methods of controlling insect pests in smart agriculture	Explain different insects, pests and the plants they damage using smart technology Describe the nature of damage caused by insect, pests to crops		Identify different species of insect and pests of agricultural importance using smart technology identify nature of damage caused by insect pests to crops..	Guide trainee to: identify insect pests. .identify nature of damage caused by insect pests to crops. carry out pest	Specimens of various insect and pests Samples of different pesticides. Pesticides

6		Explain the methods of controlling insect pests in smart agriculture		Carry out pest control using pesticides. Carry out mixing of pesticide by diluting with water.	control Carry out mixing of pesticide by diluting with water.	measuring equipment, Water, Knapsacks sprayer **PPE**
GENERAL OBJECTIVE 4.0: Understand the application of smart technology in identifying weeds and methods of control						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
7	4.1 define weeds 4.2 explain types of weeds 4.3 explain the effects of weeds on crop plants 4.4 Explain the cultural, biological, chemical and integrated methods of weed control in smart agriculture. 4.5 Describe the methods of application of herbicides.	Explain weeds Explain types of weeds Discuss the effects of weeds on crop plants Explain the cultural, biological, chemical and integrated methods of weed control in smart agriculture. Discuss methods of application of herbicides.	LCD Projector, slide projector, white board, markers, laptop computers	Identify common weeds of crops using smart app. . Identify the effects of weeds on crops using smart technologies	Assist trainee to identify common weeds. Guide students to do weed album Guide the trainee using smart apps to identify the effect of weeds on crops.	Various types of weeds. smart app.
	4.4 Explain cultural biological, chemical and integrated weed control methods	Explain cultural biological, chemical and integrated weed control methods	LCD Projector, slide projector, white board,	Carry out weed control using smart technologies and conventional methods	Guide the trainee Carry out weed control using smart technologies and	Fields and spraying equipment.

				Carry out methods of herbicide application	conventional methods Guide students apply herbicides to control weeds	
GENERAL OBJECTIVE 5.0: Understand the application of smart technology to identify nematode and methods of control						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
10	5.1 Describe nematodes 5.2 List common nematodes pest affecting crops. 5.3 Explain how nematodes affect plant **5.4** Explain methods of nematode control	Explain nematodes Explain common nematodes pest affecting crops. Explain how nematodes affect plant Describe methods of nematode control	Markers, laptop computers, pictures of insects.	identify nematodes microscope. Identify typical nematodes using smart technology Demonstrate control methods of nematodes	Guide trainee to identify nematodes Identify typical nematodes using smart technology Demonstrate control methods of nematodes	Soil with high organic content. Microscope, hand lens, smart apps. Prepared nematodes slide Fields and equipment.
GENERAL OBJECTIVE 6.0: Understand the application of smart technology in identifying vertebrate pests and methods of control						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
10	6.1 Know common crop vertebrate pests.	Discuss vertebrae pests of crops and the nature of damage they cause.	LCD Projector, slide projector, white board, markers, laptop	Identify a selection of vertebrate pests using smart technology	Guide the students to collect and identify some	Specimen of vertebrate pests e.g. rodents, birds

	6.2 Explain the nature of damage caused by vertebrate pests 6.3 Describe methods of controlling vertebrate pests.	Identify crops in which vertebrate pests are major problems. Explain the methods of controlling vertebrate pests using conventional methods and smart technologies.	computers, pictures of vertebrate pests	Identify some control tools, devices	vertebrate pests Guide trainee to identify control tools and devices and make traps	etc. Drawing or picture of vertebrate pests

YEAR ONE TERM TWO

<table>
<tr><td colspan="4">PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN SMART AGRICULTURE CRAFT PRACTICE</td></tr>
<tr><td colspan="2">MODULE: SMART NURSERY AND GREENHOUSE TECHNOLOGY</td><td>COURSE CODE: CSA 121</td><td>CONTACT HOURS:</td></tr>
<tr><td>YEAR: 1</td><td>TERM: 2</td><td>PRE: REQUISITE:</td><td>Theoretical: 36 Hours
Practical: 48 Hours</td></tr>
<tr><td colspan="4">GOAL: This module is designed to introduce the trainee to the basic knowledge and skills in smart nursery practices and greenhouse technology used in the production of horticultural crops</td></tr>
<tr><td colspan="4">GENERAL OBJECTIVES:
On completion of this module, the trainee should be able to:
1. Understand the meaning, importance and types of nurseries.
2. Understand nursery plan
3. Know the tools and equipment used in nursery operation and establishment.
4. Understand the techniques for raising seedlings.
5. Know seedling tending operations
6. Understand methods of weed, pest and disease management in a nursery.
7. Understand techniques for planting out seedlings.
8. Understand the makeup, uses and management of a greenhouse</td></tr>
</table>

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN SMART AGRICULTURE CRAFT PRACTICE						
MODULE: SMART NURSERY AND GREENHOUSE TECHNOLOGY				**COURSE CODE: CSA 121**		**CONTACT HOURS:**
YEAR: 1	**TERM:** 2	**PRE: REQUISITE:**		**Theoretical:** 2Hours **Practical:** 2Hours		
GOAL: This module is designed to introduce the trainee to the **basic knowledge and skills in smart nursery practices and greenhouse technology used in the production of horticultural crops**						
Theoretical Content				**Practical Content**		
GENERAL OBJECTIVE 1.0: Understand the meaning, importance and types of nurseries						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
1	1.1 Define Nursery. 1.2 List the importance of a nursery	Define a nursery and explain the importance of nurseries	White board marker duster projector LCD			
	1.3 List the various types of nurseries required for vegetable, plantation, and fruit crops	Explain the various types of nurseries	Whiteboard, marker, charts	Visit and observe a typical nursery setting and construct a nursery	Guide students round a typical nursery and construct a nursery.	Established nursery, plants, nails, garden soil.
	1.4 List the factors to be considered in siting a nursery.	Discuss the factors outlined in 1.4	Whiteboard, marker, charts	Identify suitable nursery sites.	Guide students to identify suitable nursery sites based on factors listed in 4.1	Vehicle, Abney hand level, hand compass.
GENERAL OBJECTIVE 2.0: Understand nursery plan						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
	2.1 Explain a plan of a nursery. 2.2 Explain the structures in a typical nursery	Describe the layout of a typical nursery.	Whiteboard, marker, duster, LCD projector,	Identify the various structures in a typical nursery.	Guide students to identify different	nursery with store, shed, water source,

			Laptop computer.		structures in a typical nursery.	fence, gate,
GENERAL OBJECTIVE 3.0: Know the tools and equipment used in nursery operations and establishment						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
	3.1 List nursery and greenhouse tools and equipment. 3.2 Explain the use of nursery tools and equipment. 3.3 Explain seedlings Production process in the Green House.	List nursery and greenhouse tools and equipment. Explain the use of nursery tools and equipment. Explain seedlings Production process in the Green House	Whiteboard, marker, duster, LCD projector and laptop computer.	Identify tools and equipment used in the nursery. Describe the seedling production process in green house	Guide students in the use of nursery tools and equipment. Describe the seedling production process in green house	Tools such as secateurs, pruning shears, watering can, hand trowel, mattock, rake, sprayers, Top soil.
GENERAL OBJECTIVE 4.0: Understand techniques for raising seedlings						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
	4.1 Explain sources of seeds. 4.2 Explain seed dormancy. 4.3 Explain methods of breaking seed dormancy. 4.4 Explain methods of sowing seeds of horticultural crops	Describe the processes outlined 4.1 to 4.4	Whiteboard, marker, LCD projector, laptop computer.	Extract and dry seeds, identify and use various methods of breaking dormancy and sowing seeds.	Guide the students to: Extract and dry seeds, identify and use various methods of breaking dormancy and sowing seeds	Fruits of guava, mango, tomato, citrus; seeds of umbrella tree, date palm, delonix; oil palm tree, tetraoxosulphate (VI) acid, knives.

	4.5 Define vegetative propagation. 4.6 List the various plant organs used for vegetative propagation.	Describe the natural vegetative propagation method	Whiteboard, marker, duster, LCD projector, chart			
	4.7 Know the different methods of sowing seeds: i. in-situ. .	Describe the different methods of sowing seeds • drilling. • broadcasting. • raising of seedlings in the nursery	Whiteboard, marker, duster, LCD projector, charts Whiteboard, marker, duster, LCD projector, charts	Raise seedlings in the field using the methods in 4.8	Guide students in carrying out the activities specified in 4.8	Dibbler, seed tray, seed box
GENERAL OBJECTIVE 5.0: Know seedling tending operations						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
	5.1 Explain thinning, pruning, cutting and pricking. 5.2 Explain methods and importance of watering in nursery tending operations	Describe the activities outlined in Describe the various ways of watering in a nursery	Whiteboard, marker, duster, LCD projector, charts	Carry out the activities in 6.1 and 6.2	Guide students in carrying out the activities in 6.1 and 6.2	Seedlings, watering cans, water, secateurs, pruning knives,
	5.3 Explain materials used for mulching and staking. 5.4 Explain the composition and uses of various types of fertilizers.	Discuss the materials of mulching and staking. Explain the composition and uses of various types of fertilizers. .		Carry out mulching, staking and composting activities	Guide students in carrying out the activities specified	Saw dust, palm fronds, rice husks, leaves and grasses, manures, chemical fertilizers such as NPK, SSP, Urea, New Dawn 4:3:1,

						Agrolizer, etc
GENERAL OBJECTIVE 6.0: Understand methods of weed, pest, and disease management in a nursery						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
	6.1 Explain the common nursery insect pests, weeds and diseases 6.2 List various methods of weeds, pests and disease management in a nursery.	Discuss the common nursery insect pests, weeds and diseases Explainvarious methods of weeds, pests and disease management in a nursery.	Whiteboard, marker, duster, LCD projector, Laptop computer, charts.	Identify various methods of weed, pest and disease management in a nursery.	Guide students to: Identify various methods of weed, pest and disease management in a nursery.	Pesticides such as Round Up, paraquat, Sherpa Plus, cypermethrin, carbendazim, mancozeb, etc
GENERAL OBJECTIVE 7.0: Understand techniques for planting out seedlings						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
	7.1 Explain the procedure for transplanting seedlings: Seedling conditioning, planting holes, etc 7.2 Outline the condition for transplanting seedlings	Explain the procedure for transplanting seedlings: Seedling conditioning, planting holes, etc Explain the condition for transplanting seedlings.	Whiteboard, marker, duster, LCD projector, charts	Carry out transplanting operations	Guide students in transplanting	Seedlings, manure, fertilizer, transplanting tools e.g., hand trowel, hand fork, spade, etc.

GENERAL OBJECTIVE 8.0: Understand the structure, uses and management of a greenhouse.						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
	8.1 Explain the term greenhouse. 8.2 List types of greenhouse 8.3 Explain the uses of a greenhouse,	Explain the term greenhouse. List types and components of greenhouse, Explain the uses of a greenhouse	Whiteboard, marker, duster, LCD projector, charts	Visit a greenhouse. .	Guide students to visit a greenhouse. .	A model greenhouse
	8.4. State the advantages and disadvantages greenhouse 8.5 Explain the layout of a greenhouse and its effects in management practices such as watering, movement and sanitation	State the advantages and disadvantages greenhouse Explain the layout of a greenhouse and its effects in management practices such as watering, movement and sanitation		Identify the layout pattern and management practices in the greenhouse.	Guide students in management practices in a greenhouse	Established greenhouse,
	8.6 Explain the environmental management practices in a greenhouse.	Discuss the environmental management practices required in the greenhouse.		Identify environmental control devices in a greenhouse.	Guide students to identify control devices.	Established greenhouse.

<table>
<tr><td colspan="4">PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN SMART AGRICLUTURE CRAFT PRACTICE</td></tr>
<tr><td colspan="2">MODULE: SMART AGRICULTURE FARMING SYSTEM</td><td>COURSE CODE: CSA 122</td><td>CONTACT HOURS:</td></tr>
<tr><td>YEAR: 1</td><td>TERM: 3</td><td>PRE: REQUISITE:</td><td>Theoretical: 36 Hours
Practical: 48 Hours</td></tr>
<tr><td colspan="4">GOAL: This module is designed to enable the trainee to understand the general principles and practices of farming systems in smart agriculture</td></tr>
<tr><td colspan="4">GENERAL OBJECTIVES:

On completion of this module, the trainee should be able to:

5.0 Understand the concept of farming systems in smart agriculture
6.0 Understand types of farming systems in smart agriculture.
7.0 Understand advantages and disadvantages of different farming systems in smart agriculture.
8.0 Understand the principles of organic farming.</td></tr>
</table>

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN SMART AGRICULTURE CRAFT PRACTICE						
MODULE: SMART AGRICULTURE FARMING SYSTEM				**COURSE CODE: CSA 122**		**CONTACT HOURS:**
YEAR: 1	**TERM:** 2	**PRE: REQUISITE:**		**Theoretical:** 36 Hours **Practical:** 48 Hours		
GOAL: This module is designed to enable the trainee to u**nderstand the concept of farming systems in smart agriculture**						
Theoretical Content				**Practical Content**		
GENERAL OBJECTIVE 1.0: U**nderstand the concept of farming systems in smart agriculture**						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
1	1.1 Define farming system in smart agriculture 1.2 Explain the difference between farming system in smart agriculture and conventional agriculture 1.3 Explain the challenges of farming system in smart agriculture	Discuss farming system in smart agriculture Discuss the difference between farming system in smart agriculture and conventional agriculture Explain the challenges of farming system in smart agriculture	**Whiteboard and marker, laptop, LCD projector.**			
GENERAL OBJECTIVE 2.0: Understand types of farming systems in smart agriculture						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
	2.1 **2.1 Outline the types of farming system associated with smart agriculture** 2.2 Describe the characteristics of farming systems in smart agriculture in 2.1	**Discuss the different types of farming systems in smart agriculture.** •Agroforestry, •Mixed farming (Integrated Crop-	**Whiteboard, Marker, LCD projector, laptop computer.**	**Identify different farming systems in smart agriculture**	**Guide students to Identify different farming systems in smart agriculture**	College demonstration farm

		Livestock Systems), •Conservation agriculture, •Organic Farming Systems, •Climate-Smart Horticulture, •Urban and peri-urban farming, •Integrated Aquaculture Systems, •Hydroponics farming, •Vertical Farming, •Aeroponics, Describe the characteristics Of farming systems in 2.1		Differentiate between the farming systems in 2.1	Guide the students to: Differentiate between the farming systems in 2.1	
GENERAL OBJECTIVE 3.0: Understand advantages and disadvantages of different farming systems in smart agriculture.						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
	3.1 Explain the advantages of farming systems in smart agriculture 3.2 Explain the Disadvantages of farming systems in smart agriculture	Outline the merits and demerits of farming systems in 2.1	**Whiteboard, marker, LCD Projector and laptop computer.**			

GENERAL OBJECTIVE 4.0: Understand the principles of organic Agriculture.						
	4.1 Explain the concept of organic Agriculture 4.2 Explain the principle of organic agriculture 4.3 Explain the objectives of organic agriculture 4.4 Enumerate the advantages and disadvantages of organic agriculture 4.5 List sources of organic amendments in organic agriculture	**Define organic Agriculture.** **Discuss the concept of organic farming to include:** **-sustainability (renewable resource).** **- health.** **- environment, etc** State the principles of organic Agriculture Outline the objectives of Organic Agriculture Discuss the advantages and disadvantages of Organic agriculture Discuss various Sources and forms of	**Whiteboard, marker, LCD Projector and laptop computer.** Samples different types of organic amendments / manure	**Compare the inputs and outputs of organic and conventional agriculture.** **Process the different materials used in organic farming.**	**Guide students to compare the inputs and outputs of organic and conventional agriculture** **Guide students to collect and process the different materials used in organic farming.**	**Organic farming farm.** **Autoclave, filters, sieves, sedim enter, distiller, mortar and pestle, hydraulic press,**

		organic soil amendment used in organic agriculture.				**refrigerator, desiccators, oven, sprayers, broadcaster**

YEAR ONE TERM THREE

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN SMART AGRICULTURE		
Course: Introduction to Smart Poultry Production.	**Course Code: CSA 131**	**Total Hours:**
Year: 1 Term: 3	**Pre-requisite:**	**Practical:**
Goal: This module is designed to provide the trainee with the basic knowledge of Smart Poultry Production		
General Objectives: On completion of this module, the trainee should be able to: 1. Understand Smart Poultry Production 2. **Understand the role of Smart poultry industry in the economy** 3. Understand Smart Poultry feeds and Feeding 4. Understand Smart Poultry Housing and Equipment. 5.		

	Theoretical Content			**Practical Content**		
General Objective1.0: Understand Smart Poultry Production						
Week 1	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
	1.1 Define Smart Poultry Production 1.2 List the different breeds of Poultry in Nigeria. 1.3 Classify the different breeds of poultry in Nigeria . 1.4 Explain each breed of poultry in 1.2 above	Explain Smart Poultry Production Explain the different breeds of Poultry in Nigeria. Discuss the different breeds of poultry in Nigeria . Explain each breed of poultry in 1.2	White board, marker, slide and LCD projectors			
	Theoretical Content			**Practical Content**		
General Objective 2.0: Understand the role of Smart poultry industry in the economy.						
Week 2	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
	2.1 Outline importance of smart poultry production	Explain the importance of smart poultry production	**Whiteboard, marker, LCD Projector and laptop computer.**			

	2.2 Outline the roles of smart poultry production in the economy 2.3 Explain the challenges of smart poultry production in Nigeria	Discuss roles of smart poultry production Describe the challenges of smart poultry production	**Whiteboard, marker, LCD Projector and laptop computer.**			
	Theoretical Content			**Practical Content**		

6. General Objective 3.0: Understand Smart Poultry feeds and Feeding						
Week	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
	3.1 Define smart poultry feeding 3.2 Outline the different methods of poultry feeding 3.3 Explain the challenges of smart poultry	Explain smart poultry feeding Describe different methods of poultry feeding	**Whiteboard, marker, LCD Projector and laptop computer.**	Identify the different feedings methods of poultry	Guide the students to identify the different feeding methods	Poultry farm Poultry Feeding materials

General Objective: 4.0 Understand Smart Poultry Housing and Equipment.						
Week	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
	4.1 Define smart poultry housing 4.2 Outline the factors to be considered in building a poultry house	Discuss and explain different poultry Houses Explain the factors to be considered like heat, environment, moisture, ventilation etc	**Whiteboard, marker, LCD Projector and laptop computer.**			
	4.3 Enumerate the equipment for poultry production	Describe the equipment for poultry production	Multi media Poultry farm	Identify equipment for poultry production	Guide the students to identify the equipment in poultry production	Poultry Farm

<table>
<tr><td colspan="4">PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN SMART AGRICULTURE CRAFT PRACTICE</td></tr>
<tr><td colspan="2">MODULE: Principles of Smart Irrigation Farming</td><td>COURSE CODE: CSA 132</td><td>CONTACT HOURS:</td></tr>
<tr><td>YEAR: 1</td><td>TERM: 3</td><td>PRE: REQUISITE:</td><td>Theoretical:
Practical:</td></tr>
<tr><td colspan="4">GOAL: This module is designed to introduce the trainee to the principle and practices of smart irrigation</td></tr>
<tr><td colspan="4">GENERAL OBJECTIVES:
On completion of this module, the trainee should be able to:
1. Understand the concept of smart irrigation
2. Understand water requirements of crops
3. understand sources of irrigation water
4. Understand the principles of smart irrigation farming
5. Know the technologies used in smart irrigation farming
6. Understand irrigation water application methods and scheduling.
7. Understand the principles of water conservation and supply.</td></tr>
</table>

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN SMART AGRICULTURE CRAFT PRACTICE						
MODULE: Principles of Smart Irrigation Farming				**COURSE CODE: CSA 132**		**CONTACT HOURS:**
YEAR: 1	**TERM:** 3	**PRE: REQUISITE:**		**Theoretical:** 36 Hours **Practical:** 48 Hours		
GOAL: This module is designed to equip the trainee with basic skills of smart irrigation						
Theoretical Content				**Practical Content**		
GENERAL OBJECTIVE 1.0: Understand the concept of smart irrigation						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
1 - 2	1.1 Define smart irrigation. 1.2 Explain the components of smart irrigation farming 1.3 Highlight the objectives of smart irrigation. 1.4 Highlight the problems of smart irrigation	Explain smart irrigation. Explain the components of smart irrigation farming Highlight the objectives of smart irrigation. Highlight the problems of smart irrigation	LCD projector, slide projector, white board, markers.			
GENERAL OBJECTIVE 2.0: Understand water requirements of crops						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
3-4	2.1 **Explain** the uses of water in plants 2.2 Describe the different forms of soil moisture e.g. gravitational water, capillary water and hygroscopic water.	Explain the uses of water and discuss the different forms of soil water and their importance to crop production.	LCD projector, slide projector, white board, markers.	See how water is held in soil Calculate the	Guide student to: Show how water is held in soil Calculate the determination of	Soil samples, water

	2.3 Explain the concept of available water, field capacity and permanent wilting point etc. 2.4 Describe about the water requirements of crops. 2.5 Explain how to Estimate irrigation water requirements e.g. the consumptive use of water. 2.6 Explain the mechanisms and importance of evapotranspiration	Explain water requirements of crops Explain how to estimate total water requirement. Explain concept of available water Explain evapotranspiration and its importance.		determination of water requirements of crops Determine water requirement of crop.	water requirements of crops Guide the student how to determine water requirement of crop.	Lysimeters, Pan evaporimeter, meteorological station
GENERAL OBJECTIVE 3.0: understand sources of irrigation water						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
5	3.1 Define irrigation 3.2 List type of irrigation 3.3 explain sources of water for irrigation 3.4 Explain factors that determine the type of irrigation	Define irrigation Explain type of irrigation Discuss sources of water for irrigation Explain factors that determine the type of irrigation	LCD projector, slide projector, white board, markers.	Identify sources of irrigation water.	Take students on excursion to nearby dams, rivers, streams	Suitable visit venues

GENERAL OBJECTIVE 4.0: Understand the principles of smart irrigation farming						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
	4.1 Define smart irrigation farming 4.2 Outline the principles of smart irrigation farming	Explain smart irrigation farming Explain the principles of smart irrigation farming to optimize water usage for crop production	LCD projector, slide projector, white board, markers.			
GENERAL OBJECTIVE 5.0: Know the technologies used in smart irrigation farming						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
	5.1 List the technologies used in smart irrigation farming 5.2 Explain the technologies used in smart irrigation farming 5.3 Explain the advantages and disadvantages of using the technologies in smart irrigation farming	Explain the technologies used in smart irrigation farming Describe the technologies used in smart irrigation farming Discuss the advantages of using the technologies in smart irrigation farming	LCD projector, slide projector, white board, markers.			

GENERAL OBJECTIVE 6.0 Understand irrigation water application methods and scheduling						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
	6.1 Describe different water application methods in irrigation 6.2. Explain the factors that determine choice of irrigation methods	Explain crop water application systems: surface irrigation, sub-surface irrigation, sprinkler irrigation, drip irrigation, Sensor-based irrigation, Variable rate irrigation, Automated irrigation, Aerial irrigation. Describe the Factors influencing the choice of irrigation methods.	LCD projector, slide projector, white board, markers.	Maintain and operate different water application method	Guide student to: Visit an existing irrigation project. Show the trainee how to maintain and operate different water application methods.	Crops field, siphon tubes, irrigation pumps source of water
	6.3 Explain how to schedule irrigation to make optimum use of water.	Describe irrigation Scheduling methods based on crop, climate and soil parameters		Practice irrigation schedule methods	Show students how to schedule irrigation.	Paper, calculators.
General Objective 7.0 Understand the principles of water conservation and supply.						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
	7.1 Explain the importance of water conservation 7.2 Outline the various methods of conserving water on the farm e.g. earth dams.	Explain the importance of water conservation practice. Describe the various methods of conserving water on	LCD projector, slide projector, white board, markers	The various forms of water conservation. Identify the ways of harnessing water resources. identify different	Guide student to: Demonstrate the various forms of water conservation techniques.	College farms

	7.3 Outline the various methods of water storage	the farm e.g. earth dams ridge-tie water. Explain the various methods of farm water storage and explain the uses of water on the farm.		water harvesting techniques Visits to irrigation farms	identify different water harvesting techniques. Organize visits to irrigation farms	College farms Irrigation site

<table>
<tr><td colspan="4">PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN SMART AGRICULTURE CRAFT PRACTICE</td></tr>
<tr><td colspan="2">MODULE: SMART ANNUAL AND INDUSTRIAL CROP PRODUCTION</td><td>COURSE CODE: CSA 133</td><td>CONTACT HOURS:</td></tr>
<tr><td>YEAR: 1</td><td>TERM: 3</td><td>PRE: REQUISITE:</td><td>Theoretical:
Practical:</td></tr>
<tr><td colspan="4">GOAL: This module is designed to introduce the trainee to annual and industrial crops</td></tr>
<tr><td colspan="4">GENERAL OBJECTIVES:

On completion of this module, the trainee should be able to:

1. Know types of annual and industrial crops
2. Understand the factors affecting crop production
3. Understand the principles of crop production
4. Understand the production techniques of industrial crops in Nigeria.
5. Understand the management of annual crops after planting
6. Understand the harvesting procedures, handling, processing and storage of annual and industrial crops.</td></tr>
</table>

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN SMART AGRICULTURE CRAFT PRACTICE						
MODULE: SMART ANNUAL AND INDUSTRIAL CROP PRODUCTION				**COURSE CODE: CSA 133**		**CONTACT HOURS:**
YEAR: 1	**TERM:** 3	**PRE: REQUISITE:**		**Theoretical:** 36 Hours **Practical:** 48 Hours		
GOAL: This module is designed to acquaint trainee with the different types of annual and industrial crops.						
Theoretical Content				**Practical Content**		
GENERAL OBJECTIVE 1.0: Know types of annual and industrial crops						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
	1.1 Explain the difference between an annual crop and a perennial crop 1.2 Explain the origin and geographical distribution of some annual and perennial crops 1.4 Outline the main producing areas of some crops in Nigeria	Explain the difference between an annual crop and a perennial crop Discuss the origin and geographical distribution of some annual and perennial crops Explain the main producing areas of some crops in Nigeria	White board, markers, slide and LCD projectors, laptop computers. Maps Textbooks, albums and charts	Differentiate between annual and industrial/tree crops Identify the annual and tree crops and their economic products Identify main producing areas in Nigeria	Guide trainee to differentiate between annual and perennial crops Guide trainee to identify annual and perennial crops in established fields and plantations. Guide students to identify production areas in Nigeria with the aid of maps and albums	College farm Visit established farms Seeds, fruits, seedlings and fully grown crops Maps Textbooks, albums and charts

GENERAL OBJECTIVE 2.0: Understand the factors affecting crop production						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
	2.1 Outline the effect of the following factors on crop production: -i. Environmental; ii. Economic; iii. Sociological.	Explain the environmental, economic and sociological factors on annual crop production	LCD projector, white board, markers, laptop computer			
3.0 GENERAL OBJECTIVE: Understand the principles of crop production.						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
	3.1 Explain the principles of crop production	List and explain the principles of crop production • Site selection; • Land preparation; • Seed selection/treatment; • Spacing.	LCD projector, white board, markers, laptop computers	Identify suitable land for annual crop production using smart technology	Guide student to: Identify suitable land for annual crop production using smart technology	Suitable visit venues.
	3.2 Explain the following terms:- • **Planting rate,** • **sowing rate and** • **population** **in terms of crop production**	**Explain the following terms:-** • **Planting rate,** • **sowing rate and** • **population** **in terms of crop production**	LCD projector, white board, markers, laptop computers			

GENERAL OBJECTIVE: 4.0 Understand the production techniques of industrial crops in Nigeria.						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
	4.1 Outline the cultivation practices for industrial/tree crops production	Explain the cultivation practice for industrial/tree crops; (i) Potting mixture; (ii) methods of seed sowing, planting date and spacing; marking-out,	Whiteboard, marker, slides and projector, laptop computer	carry out cultivation practices	Guide trainee to carry out cultivation practices	College farms
	4.2 Explain crop nursery operations	planting/transplanting,	Nursery farm			
		(iii) use of polypots in the nursery; (iv) nursery management practices like sowing, weeding, shading, watering, etc. Describe the nursery operations, e.g., nursery beds preparation, use of polypots in the nursery, potting mixture, seed sowing, planting date and spacing		Carry out nursery operations	Guide students to carry out nursery operations	College farm

GENERAL OBJECTIVE 5.0: understand the management of annual crops after planting						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
	5.2 Outline types of crop management practices 5.2 Explain appropriate timing for operations in 5.1	Explain types of crop management practices Explain appropriate timing for operations in 5.1 Highlight the appropriate timing for operation in 5.1	LCD projector, white board, markers, and laptop computer College Farm White board, markers, and laptop computer	Carry out the management practices	Guide students to carry out the various management practices	College Farm
	5.3 Explain the methods of weed control 5.4 Explain the methods pest and disease control	Explain the methods of weed control Discuss the methods pest and disease control	LCD projector, white board, markers, and laptop computer College Farm White board, markers, and laptop computer	Identify the common weeds of various fruit tree crops in the locality. Carry out spraying of organic and synthetic chemicals on different pests and diseases of crops	Guide students to identify weed of various fruit tree crops in the locality. Guide students to apply organic and synthetic chemicals.	Specimen of weeds, samples of affected plants and plant parts Samples of organic and synthetic chemicals, spraying equipment such knapsack sprayer, ULV sprayer, pesticides

GENERAL OBJECTIVE 6.0: This module is designed to introduce the trainee to the production techniques of industrial/tree crops in Nigeria						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
	6.1 Explain the harvesting procedures of annual and industrial/tree crops 6.2 Explain the criteria for determining time of harvesting of various annual crops. 6.3 Describe methods to harvest major annual crops physically from the field	Explain the harvesting procedures of annual and industrial/tree crops Explain the criteria for determining time of harvesting of various annual crops Explain the methods of harvesting crops	LCD projector, white board, markers, laptop computers. White board, markers, laptop computers.	Identify efficient harvesting methods Carry out harvesting of crops	Guide students to identify various harvesting equipment Guide students to harvest p crops	Crops and equipment/tools /machinery. College farm, harvesting tools
	6.4 Describe the handling and processing of harvested annual crops 6.5 List the methods of manual and mechanical crop processing e.g. destalking, threshing, sorting, grading decorticating.	Discuss the handling and processing of harvested annual crops . Explain the methods of manual and mechanical crop processing e.g. destalking, threshing, sorting, grading decorticating.	**College farm**	Identify major processing tools/equipment Carry out crop processing	Guide students to identify the tools/machines Guide the students to carry out crop processing	Processing tools/machines College farm Processing tools and equipment
	6.6 Outline the methods of storage of field processed products	Explain the method of storage of processed products	**White board**			

YEAR TWO TERM ONE

<table>
<tr><td colspan="4">PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN SMART AGRICULTURE CRAFT PRACTICE</td></tr>
<tr><td colspan="2">MODULE: SMART POSTHARVEST TECHNOLOGY</td><td>COURSE CODE: CSA 211</td><td>CONTACT HOURS:</td></tr>
<tr><td>YEAR: 2</td><td>TERM: 1</td><td>PRE: REQUISITE:</td><td>Theoretical:
Practical:</td></tr>
<tr><td colspan="4">GOAL: This module is designed to introduce the trainee to the basic skills and knowledge of Post harvest handling</td></tr>
<tr><td colspan="4">GENERAL OBJECTIVES:
On completion of this module, the trainee should be able to:
1. Understand the physical characteristics of crop produce
2. Understand the cleaning, sorting and separation methods of food grains and other crop produce
3. Understand the principles and methods of milling, shelling and decortication
4. Understand the various handling equipment for crop produce
5. Understand the methods of drying crop produce
6. Understand pest control and hygiene in the store
7. Understand the methods of storage and preservation of crops</td></tr>
</table>

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN ENGINEERING CRAFT PRACTICE						
MODULE: SMART POSTHARVEST TECHNOLOGY				**COURSE CODE: CSA 211**		**CONTACT HOURS:**
YEAR: 2	**TERM:** 1	**PRE: REQUISITE:**		**Theoretical:** **Practical:**		
GOAL: This module is designed to introduce the trainee to the basic skills and knowledge of post harvest handling						
Theoretical Content				**Practical Content**		
GENERAL OBJECTIVE 1.0: Understand the physical characteristics of crop produce						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
1 2	1.1 Explain visual properties of crop materials **1**.2 Explain the importance of visual properties in: • processing, • handling and • storage of crop materials.	Explain visual properties of crop materials Discuss the importance of visual properties in: • processing, • handling and storage of crop materials	LCD projectors, slide projectors, white board, markers, laptop computer	Identify the visual properties of crop materials	Guide the trainee to: Visit a farm to identify the visual properties of crop produce	Visit to farms
GENERAL OBJECTIVE 2.0: Understand cleaning, sorting and separation methods of food grains and other crop produce						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
3	2.1 Know the process of cleaning, sorting and separation of crop materials. 2.2 Know various methods of grain cleaning, sorting, grading and separation.	Describe cleaning process and separation of crop produce. Explain the processes of sorting and grading crops Explain the purpose and importance of the processes in	LCD projectors, slide projectors, white board, markers, laptop computer	Identify the equipment and smart technology used for carrying out the process in 2.1 and 2.2	Guide students to demonstrate the equipment and technology used	Unsorted crops, sieves and blowers

4	2.3 Understand the purpose and importance of each of the processes in 2.2 above	2.2				
GENERAL OBJECTIVE 3.0: Understand the principles and methods of milling, shelling and decortication						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
5	**3.1 Define** milling, shelling and decortication 3.2 Describe the various methods of shelling, milling and decortications using traditional methods and smart technology. 3.3 Know the equipment used in the operations in 3.2	Explain the operations; milling, shelling and decortication Explain the methods of the operations in 3.1	LCD projectors, slide projectors, white board, markers, laptop computer Shelling, milling and decortication tools	Carry out milling, shelling and decortications operations using appropriate equipment and smart technology. Identify equipment and smart technology for carrying out the processes in 3.2	Guide student to: Carry out milling, shelling and decortications operations using appropriate equipment and smart technology Identify equipment and smart technology used for 3.2	Shelling machine Milling machine. Decortications machine De-stoning machine De-husking machine
GENERAL OBJECTIVE 4.0: Understand the various handling equipment for crop produce						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
6	4.1 Outline handling devices for crop produce	Describe the handling of crop produce. Explain handling equipment Describe the various conveying	LCD projectors, slide projectors, white board, markers, laptop computer	.		

	4.2 Explain the various conveying handling and conveying equipment	handling and conveying equipment such as chain, belt, auger, bucket, pneumatic, oscillating and gravity conveyors, cranes, carts and trucks for handling agricultural materials				
GENERAL OBJECTIVE 5.0: Understand the smart methods of drying crop produce						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
8 9	5.1 explain the concept of drying 5.2 list the importance and purpose of drying crop produce 5.3 Outline the various methods of drying crops	Explain the process of drying crop Explain the importance and purpose of drying crops Explain the methods of crying crops; sun drying, solar drying, osmotic dehydration, microwave assisted drying, vacuum and hybrid drying	LCD projectors, slide projectors, white board, markers, laptop computer			
6. 0: GENERAL OBJECTIVES: Understand pest control and hygiene in the store						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
10	6.1 Explain the physical and economic damage that pests and diseases can cause in store 6.2 Describe the processes of detecting insects, rodents infestation and microbial attack in store using smart	Discuss why pests and diseases can be detrimental to crop storage Explain how to identify insect and microbiological organisms causing storage losses. Describe the control and prevention of insects, rodents and	LCD projectors, slide projectors, white board, markers, laptop computer	Identify insect pests and microbiological organisms causing storage losses.	Guide trainee to identify insect, rodent and microogranisms	Rodent traps,- Rodenticides- Baits.- Crop samples.

11	technology 6.3 Explain how insects and microbiological organisms can be controlled in stores and stored produce using smart technology.	microorganisms in stored products.				
GENERAL OBJECTIVES: 7.0: Understand the methods of storage and preservation of crops						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
12 **13**	7.1 Define storage and preservation 7.2 Explain the parameters for safe storage 7.3 Highlight the physiological factors which affect crop storage and quality. 7.4 Explain the various methods of storage and preservation and where each is appropriate to use.	Discuss preservation and storage of crops Describe and discuss physiological factors which affect crop storage and quality. Discuss the various methods of storage and preservation for perishable and nonperishable crops	LCD projectors, slide projectors, white board, markers, laptop computer			

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN SMART AGRICULTURE		
Course: 1.Introduction to smart fish production	**Course Code: CSA 212**	**Total Hours:**
Year: 2 Term: 1	**Pre-requisite:**	**Practical:**
Goal: This module is designed to provide the trainee with the Basic knowledge of Smart Fisheries in Nigeria		
General Objectives: On completion of this module, the trainee should be able to: **Understand the development of Smart Fish Production in Nigeria** **1. Understand the role the Smart Fish industry in the economy.** **2. Know the essential requirements for the establishment of smart fish farms** **3. Know the harvesting process of fish**		

	Theoretical Content			**Practical Content**		
General Objective1.0: 1.0 Understand the development of Smart Fish Production in Nigeria						
Week	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
1	1.1 Define Smart Fish Production 1.2 List the different improved breeds of Fish in Nigeria 1.3 Outline the different ponds used in fish production 1.4 Explain the role of smart technology in fish production	Discuss Smart fish development in Nigeria Discuss the different breeds of fish Explain the different ponds used in fish production Explain the role of smart technology in fish production	White board, marker, Slide Different fish ponds	Identify the different improved fish breeds in Nigeria Identify different fish ponds	Guide students to identify different improved Breeds Guide students to identify different fish ponds	Different breeds of Fish Internet facility Visit a fish farm

	Theoretical Content			**Practical Content**		
General Objective 2.0: Understand the role the Smart Fish industry in the economy						
Week	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
2	2.1 Describe the current state of Fish Production in Nigeria	Explain the Strength, weakness, opportunities and threats of fish farming in Nigeria	Textbooks Internet			

3	2.2 Explain the benefit of smart Fish Production in Nigeria 2.3 Explain the challenges facing smart fish production in Nigeria. 2.4 Outline strategies for promoting smart fish production in Nigeria	Discuss the economic, social and environment benefits of Smart fish Production Discuss the technical, institutional and financial challenges facing the industry in Nigeria Explain strategies for promoting Smart fish Production practices in Nigeria				
	Theoretical Content			**Practical Content**		
. General Objective: 3.0 Know the essential requirements for the establishment of smart fish farms.						
Week	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
4	3.1 Explain the scope of fish farming in Nigeria 3.2 Discuss the pre-requisites conditions for establishing a fish farm	Explain the scope of fish farming in Nigeria Explain the required conditions to establish a fish farm; water supply, water quality, climate, hydrological characteristics, soil characteristics,finance,	White board and marker			.

	3.2 Describe smart classification of ponds, water quality, soil type and stocking density.	Explain smart classification of ponds, water quality, soil type and stocking density Discuss various types of smart fish ponds				
Week	**General Objective: 4.0 Know the harvesting process of fish**					
	Specific Learning Outcomes	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
12	4.1 Explain the different methods of fish harvesting 4.2 Enumerate fish harvesting equipment used in Nigeria 4.3 Explain how to catch fish by draining the pond water.	Explain the methods of fish farming; trawls, seines, lift nets, scoop nets, cast nets, rod and line, projectile, poison, explosive etc Explain the different fish harvesting equipment	White board, marker			

<table>
<tr><td colspan="4">PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN SMART AGRICULTURE CRAFT PRACTICE</td></tr>
<tr><td colspan="2">MODULE: PRACTICES OF SMART RUMINANT PRODUCTION</td><td>COURSE CODE: CSA 213</td><td>CONTACT HOURS:</td></tr>
<tr><td>YEAR: 1</td><td>TERM: 3</td><td>PRE: REQUISITE:</td><td>Theoretical:
Practical:</td></tr>
<tr><td colspan="4">GOAL: The course is designed to provide students with a basic knowledge and of practice of ruminant animal production</td></tr>
<tr><td colspan="4">GENERAL OBJECTIVES:
On completion of this module, the trainee should be able to:
1.0 Know the importance of ruminant production
2.0 Know the different breed of ruminant animals and their characteristics
3.0 Know the types of smart housing and equipment required for ruminant animal rearing
4.0 Understand the management of adult Cattle, Sheep and Goats
5.0 Understand the nutrition and feeding of ruminant animals</td></tr>
</table>

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE						
MODULE: PRACTICES OF SMART RUMINANT PRODUCTION				**COURSE CODE: CSA 213**		**CONTACT HOURS:**
YEAR: 2	**TERM:** 1	**PRE: REQUISITE:**	**Theoretical:** **Practical:**			
GOAL: This module is designed to introduce the trainee to the smart ruminant production						
Theoretical Content				**Practical Content**		
GENERAL OBJECTIVE 1.0: Know the importance of smart ruminant production						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
1 2	1.1 list the types of ruminant animals in Nigeria 1.2 Explain the importance and benefits of ruminant animal production 1.3 Outline the usefulness of technology in ruminant animal production	Explain the types of ruminant animals in Nigeria Discuss the importance and benefits of ruminant animals production Explain the use of technology in ruminant animal production	White board and marker			
GENERAL OBJECTIVE 2.0: Know the different breed of ruminant animals and their characteristics						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
3	2.1 Describe the different breeds of ruminant animals 2.2 Explain the characteristics of the different breeds of ruminant animals 2.3 Explain the economic importance of cattle, sheep, Goats in Nigeria	Discuss the various breeds of cattle, sheep and Goats Explain the characteristics off the different breeds of ruminant animals Discuss the economic importance of cattle, sheep and goats production	White board and markers			

General Objective 3.0: Know the types of housing and equipment for ruminant animals production **Year 1, Term 1**						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
5 6	3.1 Explain the factors influencing the location of sheep, Goats and some smart houses 3.2 Explain smart house designs for cattle, sheep and Goat 3.3 Outline equipment used for rearing cattle, sheep, goats 3.4 Describe the space requirements for different Classes of sheep, Goats and Cattle	Discuss the role of smart houses in the welfare and production of sheep, Goats and swine Explain the housing designs for ruminant animals Explain the equipment used in ruminant rearing Discuss space requirement for different ruminant animal	White board and marker	Identify smart equipment for feed, water climate, Health and waste disposal in smart houses for ruminant animals	Guide student to: Identify smart equipment for feed, water climate, Health and waste disposal in smart houses for ruminant animals	Farm visit Simple Equipment
General Objective 4.0: Understand the management of adult Cattle, Sheep and Goats						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
8 8	4.1 Explain the features of good stock 4.2 Describe the management systems of ruminant animals rearing 4.3 Outline the feeding methods and equipment in ruminant animal rearing 4.3Explain the routine management practices of	Discuss features to look for when sourcing for new stock Discuss the management systems: (extensive, semi intensive and intensive) and their advantages and is advantages Discuss the common feedings methods and the equipment used	White board and marker College farm	Identification of good features to consider in purchasing of new stock	Guide students to identify features of good stock	Farm Market Animals

	ruminant animals for proper health hygiene 4.5 Explain the different terminologies associated with ruminant animal rearing	Explain the routine management practices of ruminant animals Explain the common terminologies in ruminant animal production: culling, de-beaking, de-horning and disbudding, castration, incubation, tattooing, canding, ear notching.				
General Objective: 5 Understand the nutrition and feeding of ruminant animals						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
9 10 11	5.1 Explain the digestive system of ruminant animals 5.2 List the types feeds used for cattle, sheep and goat 5.3 explain the nutrient requirements of cattle, sheep, and goats and their daily meal and water allowance 5.4 Differentiate between feeding and grazing systems 5.5 Describe the symptoms of some nutritional diseases of cattle, sheep, and goats.	Discuss the digestive system of ruminant animals Explain different feeds of ruminant animals Discuss the nutritional requirements of cattle, sheep and goats, including energy, protein, and fiber needs etc Discuss the types of grazing: zero grazing; rotational grazing etc. Discuss the symptoms nutritional diseases of cattle, sheep and goats	Charts, white board, marker			

YEAR TWO TERM TWO

<table>
<tr><td colspan="4">PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN SMART AGRICULTURE CRAFT PRACTICE</td></tr>
<tr><td colspan="2">MODULE: ENTREPRENEURSHIP IN SMART AGRICULTURE</td><td>COURSE CODE: CSA 221</td><td>CONTACT HOURS:</td></tr>
<tr><td>YEAR: 2</td><td>TERM: 2</td><td>PRE: REQUISITE:</td><td>Theoretical: 36 Hours
Practical: 48 Hours</td></tr>
<tr><td colspan="4">GOAL: This module is designed to introduce the trainee to the basic knowledge of Entrepreneurship Education in Agriculture</td></tr>
<tr><td colspan="4">GENERAL OBJECTIVES:

1.0 Understand the importance of Entrepreneurship education
2.0 Understand Entrepreneurial Mind set and Leadership
3.0 Understand Business Idea Generation and Validation
4.0 Understand Marketing and Sales for Entrepreneurs</td></tr>
</table>

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN SMART AGRICULTURE						
MODULE: ENTREPRENEURSHIP IN SMART AGRICULTURE				**COURSE CODE: CSA 221**		**CONTACT HOURS:**
YEAR: 2	**TERM:** 2	**PRE: REQUISITE:**		**Theoretical:** **Practical:**		
GOAL: This module is designed to introduce the trainee to the						
Theoretical Content				**Practical Content**		
GENERAL OBJECTIVE 1.0 Understand the importance of Entrepreneurship education						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
1 2	1.1 Define Entrepreneurship education 1.2 Outline the importance of entrepreneurship in agriculture 1.3 List the Types of entrepreneurship (e.g., small business, scalable startup, social entrepreneurship) 1.4 List the key characteristics of entrepreneurs (e.g., risk-taking, innovation, resilience)	Explain the terms Entrepreneurship education Explain the importance of entrepreneurship in agriculture Discuss Types of entrepreneurship (e.g., small business, scalable startup, social entrepreneurship) Discuss the key characteristics of entrepreneurs (e.g., risk-taking, innovation, resilience)	White board and markers			
GENERAL OBJECTIVE 2.0: Entrepreneurial Mindset and Leadership						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
3	2.1 Define mind set 2.2 Explain how to Develop an entrepreneurial positive mindset 2.3 Describe Enterpreneurship leaderhip styles	Explain the term mind set Discuss the processes of developing positive mindset (e.g., creativity, adaptability, resourcefulness etc) Discuss the different leadership	As above			As above

4	2.4 Explain the characteristics and leadership qualities of good entrepreneurs	styles Explain the characteristics and leadership qualities of good entrepreneurs				
GENERAL OBJECTIVE 3.0: Business Idea Generation and Validation						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
5 6	3.1 Define business ideas 3.2 Explain the Techniques for generating business ideas 3.3 Describe business ideas through market research and analysis	Explain the term business idea Explain the processes of generating a business idea (e.g., brainstorming, market research etc) 3.3 Explain business ideas through market research and analysis	As above		Guide students	As above
GENERAL OBJECTIVE 4.0: understand Marketing and Sales for Entrepreneurs						
	Specific Learning Outcome	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**
7 8	4.1 Define marketing 4.2 Explain the importance of marketing in agriculture 4.3 Explain the different Marketing channels	Explain marketing Discuss the importance of marketing in agriculture Discuss the different marketing channels	As above			

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN SMART AGRICULTURE		
Course: INTRODUCTION TO SMART ANIMAL HEALTH	**Course Code: CSA 222**	**Total Hours:2**
Year: 2 Term: 2	**Pre-requisite:**	**Practical: 2**
Goal: This course is designed to acquaint students with the basic practices of smart animal diseases and control		
General Objectives: On completion of this module, the trainee should be able to: 1. Understand the classification of animal diseases 2. Know how to identify healthy and sick animals 3. Understand the practices to ensure good health of animals 4. Know common disease caused by bacteria and viruses		

	Theoretical Content			**Practical Content**		
5. **General Objective1.0:** Understand the classification of animal diseases						
Week	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
1 **2**	1.1 Define of Disease 1.2 Explain the terms related to disease 1.3 Explain the classification of diseases according to causative agents e.g. bacteria; viruse	Define Disease Discuss the following diseases related terms infection endemic, epidemic pandemic,sporadic Contagious, acute Chronic, mild discuss the classification of diseases according to causative agents e.g. bacteria; viruses	White board, marker, slide and LCD Projectors Multimedia teaching aids	Identify The different different types disease .	guide students to identify different disease with understanding of the disease related terms	Deep learning-based Classification Expert System-based Classification Computer vision
	Theoretical Content			**Practical Content**		
6. **General Objective 2.0:** Know how to identify healthy and sick animals						
Week	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
3	2.1 Explain the importance of smart identification of healthy and sick animals from the herd	Describe specific characteristics of healthy and sick animals				

4	2.2 Describe the specific characteristics of healthy and sick animals 2.3 Explain physical symptom of health and sick animals	Explain the specific characteristics Discuss the physical symptoms in eyes, nostrils, mouth, head, neck ear, legs, anus and other parts of the animals body	Animals Farm	Identify the physical symptoms of healthy and sick animals	Guide the students to identify the physical symptoms	Animal Farm
	Theoretical Content			**Practical Content**		
7. **General Objective: 3.0** Understand the practices to ensure good health of animals						
Week	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
5 **6**	3.1 Explain the parameters to measure healthy animals 3.2 Describe the routine hygiene practices for healthy animals 3.3 Explain the importance of healthy animals in animal rearing	Discuss the features to consider in healthy animals mortem Discuss the daily routine farm practices to ensure healthy animals Explain the importance of keeping animals healthy in livestock rearing	White board and markers			.

8. **General Objective: 4.0: Identify common disease caused by bacteria and viruses**						
Week	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
8 & 9	4.1 Explain bacterial and viral diseases 4.2 Describe the common bacterial and viral diseases in livestock production 4.3 List some of the symptoms of the diseases in 4.2	Explain what are bacterial and viral diseases Discuss the common bacterial and viral diseases in livestock rearing				
10 & 11		Discuss the symptoms of bacterial and viral diseases in livestock rearing	Animals and Farm	Identify the symptoms of bacterial and viral diseases	Guide the students to identify the symptoms of bacterial and viral diseases	Animals, Visit to farms for visual observations

<table>
<tr><td colspan="4">PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN SMART AGRICULTURE CRAFT PRACTICE</td></tr>
<tr><td colspan="2">MODULE: SMART SOIL MANAGEMENT</td><td>COURSE CODE: CSA 223</td><td>CONTACT HOURS:</td></tr>
<tr><td>YEAR: 2</td><td>TERM: 2</td><td>PRE: REQUISITE:</td><td>Theoretical: 36 Hours
Practical: 48 Hours</td></tr>
<tr><td colspan="4">GOAL: This module is designed to introduce the trainee to the general practices of soil management and crop nutrition.</td></tr>
<tr><td colspan="4">GENERAL OBJECTIVES:
On completion of this module, the trainee should be able to:
1. Understand basic principles to soil management
2. Understand soil properties and Testing
3. Understand Soil Fertility and Nutrient Management
4. Understand Soil Conservation Practices
5. Understand the Sustainable Soil Management Practices</td></tr>
</table>

General Objective 1.0: Understand basic principles to soil management						
Week	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
	1.1 Explain soil, composition and structure 1.2 List the roles of soil sustainable agriculture and food security 1.2 Explain soil degradation	**Discuss soil, soil composition and soil structure** **List the roles of soil in sustainable agriculture** **Discuss soil degradation, causes, effects and prevention**				
General Objectives 2.0: Understand soil Soil properties and Testing						
Week	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
	2.1 Outline the physical properties of soil 2.2 Outline the Chemical Soil properties 2.3 Enumerate the biological properties of soil 2.4 Discuss the soil testing	Discuss the physical properties of soil: Texture, structure, and porosity Explain chemical properties of soil; pH, nutrient content, and cation exchange capacity Discuss the	Top soil			

	techniques	biological properties of soil: Soil microbes and organic matter Explain soil testing techniques: Sampling methods, laboratory analysis, and interpreting results.				
General Objectives 3.0: Understand Soil Fertility and Nutrient Management						
Week	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
	3.1 Explain soil Essential Nutrients 3.2 Outline fertilizer types and application on the soil Explain soil nutrient Management Plans:	Discuss macro and micro nutrients required for plant growth Explain types of fertilizer: Organic and inorganic fertilizers, application methods, and timing. Discuss the Development and implementation of effective nutrient management plan	White board, marker and multi media			

General Objectives 4.0: Understand Soil Conservation Practices						
	Specific Learning Outcomes	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
	4.1 Explain soil conservation 4.2 Discus soil erosion 4.3 Outline soil conservation practices	Discuss the meaning of soil conversation Explain the meaning of soil erosion and the techniques to prevent it: (e.g., contour plowing, terracing). Explain practices to conserve the soil: cover cropping, crop Rotation and conservation Tillage	White board, marker and multi media			
General Objectives 5.0: Understand Sustainable Soil Management Practices						
	Specific Learning Outcomes	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
	3.1 Explain sustainable soil management 5.2 Outline sustainable soil management practices	Discuss the meaning of sustainable soil management Discuss soil management practices:organic farming,	White board, marker and multi media			

		Agroforestry, composting and mulching				
	5.3 Explain Integrated Pest Management System (IPMS)	Discuss the meaning of IPMS and the implication to agriculture				

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN SMART AGRICULTURE		
Course: INTRODUCTION TO FARM MANAGEMENT	**Course Code: CSA 232**	**Total Hours:2**
Year: 3 Term: 2	**Pre-requisite:**	**Practical: 2**
Goal: This course is designed to acquaint students with the basic principles of farm management		
General Objectives: On completion of this module, the trainee should be able to: 1.0 Understand the overview in farm management 2.0 Understand farm planning and decision making 3.0 Understand the basic crop and livestock management 4.0 Understand basic marketing and sales strategies 5.0 Understand basic risk management		

	Theoretical Content			**Practical Content**		
General Objective1.0: Understand the overview in farm management						
Week	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
1	1.1 Explain farm management, importance and principles 1.2 Outline the types of farming system 1.3 Outline the challenges of farming system in Nigeria	Discuss the meaning of farm management, it□s importance and principles Explain the different types of farming system; subsistence, commercial farming Organic and conventional farming Discuss the different challenges of farming system	White board, marker, slide and LCD Projectors Multimedia teaching aids	.		
General Objective2.0: Understand farm planning and decision making						
Week	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
	2.1 Explain farm planning 2.2 Outline the goals and objectives of farm planning 2.3 Developing a farm plan for a farm enterprise	Discuss the concept farm planning Explain the various goals and objectives of farm planning Draw a farm plan for a farm enterprise	White board, marker, slide and LCD Projectors Multimedia teaching aids Card board paper, pen, marker	Design a farm plan of a farm enterprise	Guide the students to design a farm plan for a farm enterprise	Card board paper, pen, marker

	2.4 Explain farm Decision-Making Processes	Discuss farm decision making process	White board, marker, slide and LCD Projectors Multimedia teaching aids			
General Objective 3.0: Understand the basic crop and livestock management						
Week	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
	3.1 Explain crop management practices 3.2 Explain livestock management practices 3.3 Outline the basic challenges crop and livestock management in Nigeria	Discuss crop basic crop management practices: Crop selection and rotation Soil fertility and pest management Discuss basic livestock management practices: Selecting and breeding livestock Animal health and nutrition Discuss the challenges faced by farmers in crop and livestock management in Nigeria	White board, marker, slide and LCD Projectors Multimedia teaching aids			

General Objective 4.0: Understand basic marketing and sales strategies						
Week	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
	4.1 Explain marking demand 4.2 Outline marketing targets 4.3 Explain different sale strategies	Discuss marking demand and its importance in agriculture produce marketing Discuss different market targets in agriculture Discuss agricultural sales strategies	White board, marker, slide and LCD Projectors Multimedia teaching aids .			
General Objective 5.0: Understand basic risk management						
Week	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
	5.1 Explain risk management 5.2 Explain different risk associated with agriculture 5.3 Outline the different agricultural risk management strategies	Discuss the meaning of risk management Discuss various agricultural risks Discuss the different risk management strategies in agriculture: •Diversification •Insurance •hedging etc	White board, marker, slide and LCD Projectors Multimedia teaching aids White board, marker, slide and LCD Projectors Multimedia teaching aids			

YEAR 3 TERM TWO

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN SMART AGRICULTURE		
Course: Introduction to Smart Agricultural Extension	**Course Code: CSA 312**	**Total Hours:**
Year: 3 Term: 1	**Pre-requisite:**	**Practical:**
Goal: This module is designed to provide the trainee with the basic knowledge to smart Agricultural Extension		
General Objectives: On completion of this module, the trainee should be able to: 1. Understand Smart Agricultural Extension 2. Know about the Digital technologies in Smart Agricultural Extension 3. Know agricultural extension information dissemination methods 4. Know the teaching methods in agricultural extension 5. Know the community engagement approaches in agricultural extension		

	Theoretical Content			**Practical Content**		
General Objective 1.0: Understand Smart Agricultural Extension						
Week	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
1 **2**	1.1 Define smart agricultural extension 1.2 Outline the importance extension in agriculture 1.3 Explain the key components of a smart agricultural extension . 1.3 Explain the benefits of smart agricultural extension	Explain smart agricultural extension Discuss the importance of agricultural extension in agriculture Explain the components of smart agricultural extension: digital technologies, simple data analysis and precision agriculture Discuss the benefits of smart agricultural extension: improved crop yields, reduced costs and enhanced environmental sustainability etc	White board, marker, slide and Multimedia teaching aids			

	Theoretical Content			**Practical Content**		
General Objective 2.0: Know the Digital technologies in Smart Agricultural Extension						
Week	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
	2.1 Describe the different types of digital devices used in agricultural extension	Discuss the types of digital devices used in agricultural extension	Multi media devices, white board			
	2.2 Explain the role of digital technologies in enhancing farmer outreach, engagement, and education. 2.3 Describe the challenges and of using digital technologies in agricultural extension	Discuss the roles of digital technologies in enhancing farmers outreach, engagements and education Explain the challenges of using digital technologies in agricultural extension				
	Theoretical Content			**Practical Content**		
General Objective: 3.0 Know agricultural extension information dissemination methods						
Week	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
6	3.1 Define information dissemination 3.2 Outline the channels of communication	Explain information dissemination Discuss the channels of discussion in agricultural extension Discuss the roles of	Charts, white board Projectors Multi media			.

7	3.3 List the roles of information and communication in extension service	information and communication in extension service				
6. General Objective 4: Know the teaching methods in agricultural extension						
WEEK	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
	4.1 Differentiate between agricultural extension and extension education 4.2. Outline the various extension teaching methods in agricultural extension 4.3. Enumerate the importance of teaching in farmer education	Explain the differences between agricultural extension and extension education Explain the extension teaching methods Explain the role of teaching in rural farmer education	White board, marker Multi media			
General Objectives 5.0: Know the community engagement approaches in agricultural extension						
WEEK	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
	5.1 Explain community engagement 5.2 Outline the importance of community engagement in extension service delivery	Discuss what community engagement means. Explain the important roles of community engagement in	White board, marker and multi media			

	5.3 Explain the different community engagement approaches	extension service delivery Discuss the different community engagement approaches				

YEAR 3 TERM THREE

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN SMART AGRICULTURE						
Course: SMART AGRICULTURAL MARKETING			**Course Code: CSA 331**		**Total Hours:2**	
Year: 3	**Term: 2**		**Pre-requisite:**		**Practical: 2**	
Goal: This course is designed to acquaint students with the basic concepts and practice of smart agricultural marketing						
General Objectives: On completion of this module, the trainee should be able to: 1.0 Understand the overview of agricultural marketing 2.0 Understand agricultural marketing channels 3.0 Understand digital marketing strategies 4.0 Understand customer relationship management (CRM) 5.0 Understand branding and promotion						
	Theoretical Content			**Practical Content**		
General Objective1.0: Understand the overview of agricultural marketing						
Week	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
1	1.1 Explain agricultural marketing it□s importance 1.2 Distinguish between traditional and smart agricultural marketing 1.3 Outline the benefits of smart agricultural marketing to farmers	Define agricultural marketing and states the importance Discuss the distinctions between traditional and smart agricultural marketing Explain the benefits of smart marketing to farmers	White board, marker, slide and LCD Projectors Multimedia teaching aids	.		

General Objective 2.0: Understand agricultural marketing channels						
Week	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
	2.1 Explain marketing channel 2.2 Explain the different market distribution channels in agriculture 2.3 Outline the challenging factors to efficient distribution of agricultural produce	Discuss the meaning of marketing channel Discuss the different market distribution channels of agricultural produce Explain the challenges faced in distributing agricultural produce	White board, marker, slide and LCD Projectors Multimedia teaching aids			
General Objective 3.0: Understand digital marketing strategies						
Week	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
	3.1 Explain the term marketing strategy 3.2 Outline different digital marketing platforms 3.3 Outline the challenges associated with the use of digital marketing platforms	Discuss the meaning of marketing strategy Explain different digital marketing platforms; (Facebook, Instagram, Twitter), Email Marketing, Engine Optimization (SEO) Explain the the challenges of using digital marketing platforms for agricultural produce	White board, marker, slide and LCD Projectors Multimedia teaching aids			

General Objective 4.0: Understand Customer Relationship Management (CRM)						
Week	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
	4.1 Explain customer relationship management in agricultural marketing 4.2 Outline the importance of customer relationship to a farmer 4.3 Explain customer relationship management approaches	Discus the meaning of customer relationship management Discuss the importance of customer relation to a typical Nigerian farmer Discuss the different approaches to customer relationship	White board, marker, slide and LCD Projectors Multimedia teaching aids			
General Objective 5.0: Understand branding and promotion						
Week	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcomes**	**Teacher□s Activities**	**Resources**
	5.1 Explain branding in marketing 5.2 Explain promotion in agricultural marketing 5.3 Outline the different promotional strategies	Discuss the meaning of branding in marketing Discuss promotions in agricultural marketing Discuss different promotional strategies; Online advertising (Google Ads, Facebook Ads) Offline promotions (farmers' markets, local events)	White board, marker, slide and LCD Projectors Multimedia teaching aids			

LIST OF EQUIPMENT
CROP FARM

1. Experimental/Demonstration Farm
2. Horticultural farm

AUDIO VISUAL ROOM

Video recorder	1
Slide projector	1
Overhead projector	1
Film projector	1
Magnetic board	1
Public address system	1
Television set	
Cameras	

FARMS TOOLS AND EQUIPMENT

1. Seed drill	**1**
2. Fertilizer spreader	**1**
3. Manual maize planter	**1**
4. Cutlass	**5**
5. Spade	**5**
6. Shovel	**5**
7. Hoe	**5**
8. Sacataurs	**5**
9. Rake	**5**
10. Hand trowel	**5**
11. Sickle	**5**
12. Axe	**5**
13. Digger	**5**
	5

NURSERY TOOLS

Watering System (Spraying)	5
Seed sowers	5
Root prunners	5
Plant lifters	5
Flame weeders and hedgers	5
G.H.P. pump	5
Secateurs	5
Spade	5
Pickaxe	5
Wheel barrow	5
Watering cans	5
Head pans	5
Matchets	5
Cutting knives	5
Planting hoes	5
Nursery trays	5
Hand trowel	5
Hand fork	5
Cutting knives	5
Germination boxes	5
	5
	5
	5
	5
	5

Crop Processing and Storage Facilities

1. Grain /vegetables driers	1
2. Cassava peeler	1
3. Cassava grater	1
4. Silos	1
5. Cribs	1
6. Rumbus	1
7. Refrigerator	3
8. Frying pan	10
9. Storage bags	5
10. Storage containers	
11. Grain sieve	

1.0 Irrigation Equipment

Sprinkler irrigation kit 2,000	1
Rotating sprinkler for 1 Ha	1
Electric motor pump	1
Tensiometer	1
Hygrometer	1
Evaporator guage	1
Soil pH meter	1
Irrigation water testing set	1
Water measuring devices	1
(I) Weir	1
(II) Parshal flume	
(III) Cut throat flume	
(IV) Flow meter	
Irrigation equipment store	

Meteorological Equipment

Stevenson□s screw	1
Thermohydrographs	1
Max. and Min. Thermometer	1
Rain guage	1
Measuring glasses	1
Wined Vane	1
Anaemometer	1
Evaporimeters	1
Hygrometers	
Barometers	

Entomology and Pest Control Laboratory

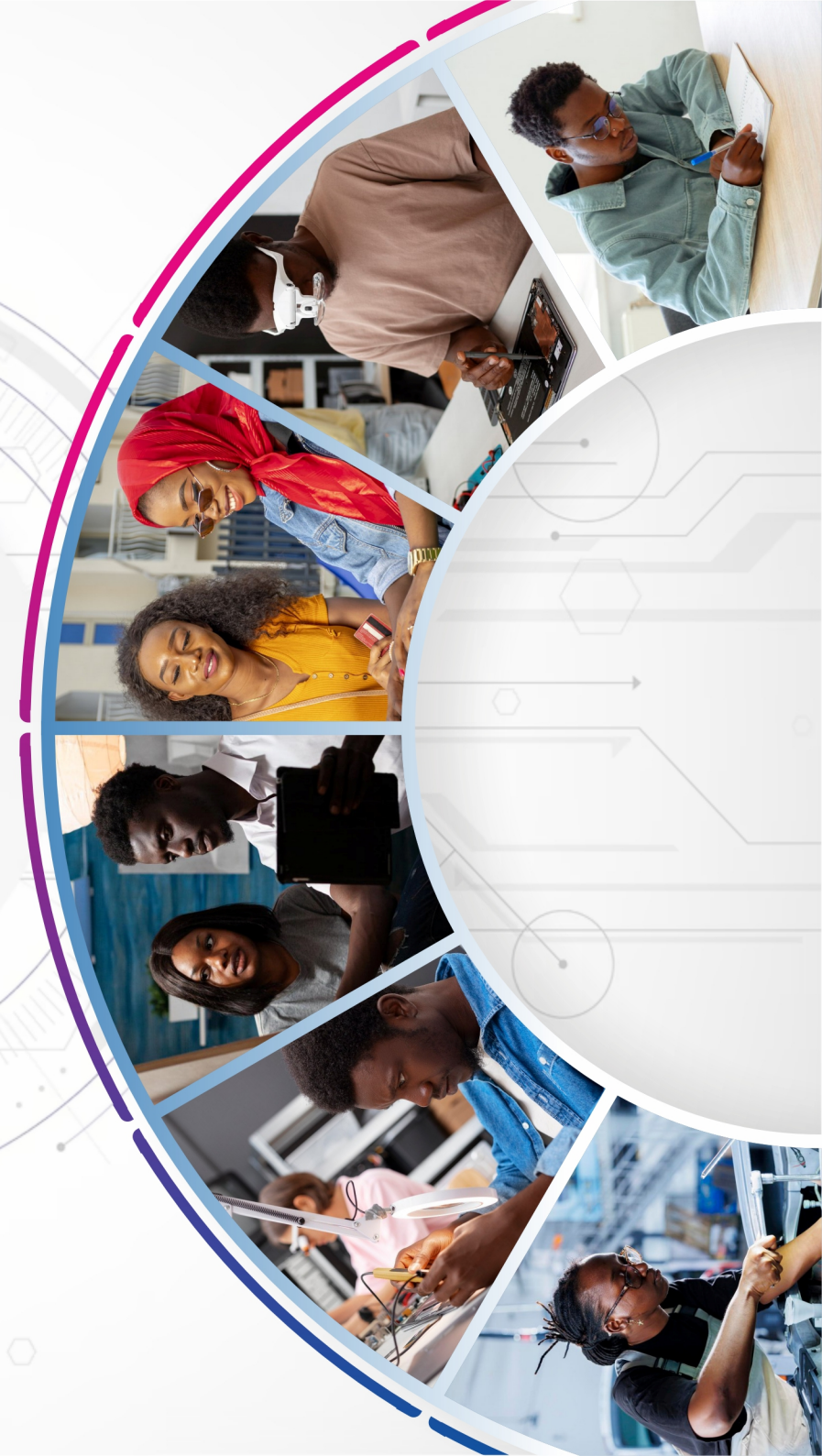
Magnifying glasses	5
Insect cages and cabinets	1
Specimen bottles	5
Insect nets	4
Lamps	2
Misc nets	3
Cool boxes	2
Knapsack pressure sprayer	2
Motorised mist sprayer	1
Handy sprayer	2
Ultra low volume sprayer	1
Electrodyne sprayers	2
Boom sprayer	2
	1
	1
	1

Livestock farm

Broilers	50 nos	
Pullet		50 nos
Pigs		5 nos
Sheep		5 nos
Goat		5 nos
Rabbit		5 nos
Cattle		1 nos

OTHERS

Fish pond
GPS
GIS
pH meter



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