FEDERAL MINISTRY OF EDUCATION

National Technical Certificate (NTC) Curriculum in

AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANICS WORK CRAFT PRACTICE

February, 2025

NBTE

NBTE-IDEAS

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

AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANICS WORK CRAFT PRACTICE

2025

GENERAL INFORMATION

AIM
To give training and impact 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 sponsored candidates with lower academic qualifications who hold trade test certificate and are capable of benefiting from the programme.

Advanced Craft Programme
Candidates should possess the National Technical Certificate or its equivalent and should have had a minimum of two years post qualification cognate industrial experience.

The Curriculum
The Curriculum of each programme is broadly divided into three components:
a. General Education, which accounts for 30% of the total hours required for the programme.
b. Trade Theory, Trade Practice and Related Studies which account for 65% and,
c. Supervised Industrial Training/Work Experience which accounts for about 5% of the total hours required for the programme. This component of the course which may be taken in industry or in the College production unit is compulsory for the full-time students.

Included in the curriculum are the teacher's activity and learning resources required for the guidance of the teacher.

Unit Course/Modules
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:

a Power Unit
b Implement and Machine
c Transmission
d Precision agriculture
e Climate change

Specific learning outcomes are concise statements of the specific behavior expressed in units of discrete practical tasks and related knowledge the students should demonstrate as a result of the educational process to ascertain that the general objectives of course/ programme have been achieved. They are more discrete and quantitative expressions of the scope of the tasks contained in a teaching unit.

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, Mathematics, 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.

For the purpose of certification, only the first three courses in mathematics will be required. The remaining modules are optional and are designed for the above average students.

National Certification
The NTC programmes are run by Technical Colleges accredited by N.B.T.E.
NABTEB conducts the final national examination and awards certificates.

Trainees who successfully complete all the courses/ modules specified in the curriculum table and passed the nnational examinations in the trade will be awarded one of the following certificates:

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

Table of Contents

PROGRAMME: **NATIONAL TECHNICAL CERTIFICATE IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANICS WORK**

GOAL: The Agricultural Equipment and Implement Mechanics Programme is intended to produce a mechanic who should be able to diagnose faults, carry out repairs and maintenance to tractors, agricultural equipment and their implement, the trainee should also have an in-depth theoretical knowledge of its operations.

CURRICULUM TABLE (NTC)
NATIONAL TECHNICAL CERTIFICATE IN

S/No	Subject Code	Module	YEAR 1						YEAR 2						YEAR 3						Total Hours
			Term 1		Term 2		Term 3		Term 1		Term 2		Term 3		Term 1		Term 2		Term 3		
			T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	
1	CMA 11 - 14	Mathematics	2		2		2		2		2		2		2		2		2		216
2	CEN 11 - 17	English	2		2		2		3		3		3		3		3		3		288
3	CCH 10 - 12	Chemistry	2		2		2		1	2	1	2	1	2	1	2	1	2	1	2	288
4	CPH 10-12	Physics	2		2		2		1	2	1	2	1	2	1	2	1	2	1	2	288
5	CEC 11-13	Economics	2		2		2		2		2		2		2		2		2		216
6	CBM 10	Entrepreneurship													2		2		2		72
7	ICT 11-15	Computer studies							1	2	1	2	1	2	1	2	1	2			180
8	CTD 11 - 13	Drawings		3		3		3		3		3		3							216
9	CAM 111	Health, Safety and Environment	1	1																	72
10	CAM 112	Use of Workshop Tools and Equipment	1	2																	72
11	CAM 113	Basic Agriculture Science	2	1																	72
12	CAM 121	General Metal Work I			2	3															72
13	CAM 122	Material and Work Process			2	3															72
14	CAM 123	Introduction to Agricultural Mechanization			2	1															72
15	CAM 131	Introduction to Tractor					2	1													72
16	CAM 132	General Metal Work II					2	3													72

17	CAM 211	Alternative Energy Mechanization							2	1												72
18	CAM 212	Implements and Machines I							1	2												72
19	CAM 213	Machining Operations I							1	3												72
20	CAM 221	Tractor and its Components									1	3										72
21	CAM 222	Implements and Machines II									1	2										72
22	CAM 231	Tractor and its components II											1	3								72
23	CAM 232	Transmission System I											2	4								72
24	CAM 233	Tractor Undercarriage											2	4								72
25	CAM 234	Irrigation Equipment											2	2								72
26	CAM 311	Transmission System II													2	4						72
27	CAM 312	Auto Electricity													2	4						144
28	CAM 313	Harvesting and Post Harvesting													2	1						72
29	CAM 321	Machinery Management															2	1				144
30	CAM 322	Maintenance and Troubleshooting of Tractors															1	3				144
31	CAM 323	Wheels and Tires															1	2				72
32	CAM 331	Precision Agriculture																	1	2		72
33	CAM 332	Tractors and their Power Unit																	2	3		72
		GRAND TOTAL	**14**	**11**	**14**	**11**	**14**	**11**	**14**	**17**	**14**	**17**	**14**	**19**	**16**	**18**	**16**	**18**	**15**	**14**		**3204**

<table>
<tr><td colspan="3">PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE</td></tr>
<tr><td>MODULE: HEALTH, SAFETY AND ENVIRONMENT</td><td>SUBJECT CODE: CAM 111</td><td>CONTACT HOURS:</td></tr>
<tr><td rowspan="2">YEAR: 1 TERM: 1</td><td rowspan="2">PRE: REQUISITE:</td><td>THEORETICAL:</td></tr>
<tr><td>PRACTICAL:</td></tr>
<tr><td colspan="3">GOAL: This module is designed to introduce the trainee to the fundamentals of general Health, Safety and Environment.</td></tr>
<tr><td colspan="3">GENERAL OBJECTIVE: On completion of this module, the trainee should be able to:

1.0 Understand the application of safety rules and regulations in the workplace/environment

2.0 Understand hazards and their control measures

3.0 Understand the safe work procedures

4.0: Know the safety of facilities and equipment in the workplace/environment</td></tr>
</table>

PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE						
MODULE: HEALTH, SAFETY AND ENVIRONMENT			**SUBJECT CODE:** CAM 111		**CONTACT HOURS:**	
YEAR: 1 **TERM:** 1			**PRE: REQUISITE:**		**THEORETICAL:**	
					PRACTICAL:	
GOAL: This module is designed to introduce the trainee to the fundamentals of general Health, Safety and Environment.						
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
GENERAL OBJECTIVE 1.0: Understand the application of safety rules and regulations in the workplace/environment						
WEEK	**SPECIFIC LEARNING OUTCOME**	**TEACHER'S ACTIVITIES**	**RESOURCES**	**SPECIFIC LEARNING OUTCOME**	**TEACHER'S ACTIVITIES**	**RESOURCES**
1-3	1.1 Explain the applications of factory safety regulations in the machine shop 1.2 Name safety equipment and wears essential in the machine shop e.g.: • Overall • Eye goggles • Gloves • Safety boots • Helmet • Fire extinguishers etc. 1.3 State the application of 1.2 above in working situations	Explain the applications of factory safety regulations in the machine shop Explain safety equipment and wears essential in the machine shop e.g.: • Overall • Eye goggles • Gloves • Safety boots • Helmet • Fire extinguishers etc. Explain the application of 1.2 above in working situations	Safety posters Whiteboard Projector Marker Computer Internet Slides Textbooks	Identify safety equipment and wears essential in the workplace/environment Demonstrate how to use safety equipment and wears essential in the workplace/environment	Guide students to: Identify safety equipment and wears essential in the workplace/ environment Demonstrate how to use safety equipment and wears essential in the workplace/ environment Demonstrate safe ways of handling basic hand tools	Farm tools box PPE Television Video Player

	1.4 Outline safety rules and regulations relating to: • PPE • Tools handling and storage • Fire protection equipment etc.	Explain safety rules and regulations relating to: • PPE • Tools handling and storage • Fire protection equipment etc.		Demonstrate safe ways of handling basic hand tools Show a film on industrial safety	Show a film on industrial safety	

GENERAL OBJECTIVE 2.0: Understand hazards and their control measures						
4-7	2.1 Define hazard 2.2 Explain the following: • Occupational hazard • Educational hazard • Health hazard etc. 2.3 List types of hazards: **i. Biological hazards:** • Exposure to viruses, bacteria, or other contagious conditions; • A common risk for utility workers, construction and demolition professionals	Explain hazard Explain the following: • Occupational hazard • Educational hazard • Health hazard etc. Explain types of hazards: **i. Biological hazards:** • Exposure to viruses, bacteria, or other contagious conditions; • A common risk for utility workers, construction and demolition professionals	Safety posters Whiteboard Projector Marker Computer Internet Slides Textbooks	Identify types of hazards and how to prevent them. Identify potential hazards in a mock workplace Demonstrate safe handling of tools in workplace	Guide students to: Identify types of hazards and how to prevent them. Identify potential hazards in a mock workplace Demonstrate safe handling of tools in workplace Demonstrate the procedures to be taken in the event	Television Video player Posters Farm tools First aid box Fire point equipment

	ii. Chemicals hazards • Exposure to chemicals in the workplace, such as cleaning products or industrial chemicals; • Can cause skin irritation, respiratory issues, blindness, corrosion and explosions **iii. Physical hazards** • Unsafe working conditions that can cause injury, illness and death • Hazards that leads to slip, trips and falls. **iv. Psychosocial hazards** • Factors in the workplace that can harm an employee's mental health and well being • Can include high level of stress, harassment, bullying and other forms of psychological abuse • Anything that causes an employee stress or strain	**ii. Chemicals hazards** • Exposure to chemicals in the workplace, such as cleaning products or industrial chemicals • Can cause skin irritation, respiratory issues, blindness, corrosion and explosions **iii. Physical hazards** • Unsafe working conditions that can cause injury, illness and death • Hazards that leads to slip, trips and falls. **iv. Psychosocial hazards** • Factors in the workplace that can harm an employee's mental health and well being • Can include high level of stress, harassment, bullying and other forms of psychological abuse • Anything that causes an employee stress or strain		Demonstrate the procedures to be taken in the event of workplace accident	of workplace accident	

	• Can include aggression and violence in the workplace 2.4 State sources of hazards in the workplace 2.5 State how to prevent and control hazards in workplace/ environment 2.6 Explain first aid management in workplace	• Can include aggression and violence in the workplace Explain sources of hazards in the workplace Explain how to prevent and control hazards in workplace/ environment Explain first aid management in workplace				

GENERAL OBJECTIVE 3.0: Understand the safe work procedures						
8-10	3.1 Define Safe Work Procedure 3.2 State the purpose of a safe work procedure: • Identify hazard • Assess risks • Implement controls • Train workers	Explain Safe Work Procedure Explain the purpose of a safe work procedure: • Identify hazard • Assess risks • Implement controls	Safety posters Whiteboard Projector Marker Computer Internet	Identify safe work procedure Demonstrate different methods of collecting, treating and disposing of waste in workplace	Guide students to: Identify safe work procedure Demonstrate different methods of collecting, treating	SWP Manual Sample waste Plastic collector

	3.3 Discuss the benefits of safe work procedures: • Reduced risk of injury • Improve efficiency • Compliance with regulations • Increased worker confidence 3.4 Define risk management 3.5 Explain the types of risk management 3.6 Explain waste management and disposal 3.7 Explain the different methods of collecting, treating and disposing of waste in workplace	• Train workers Explain the benefits of safe work procedures: • Reduced risk of injury • Improve efficiency • Compliance with regulations • Increased worker confidence Explain risk management Explain the types of risk management Explain waste management and disposal Explain the different methods of collecting, treating and disposing of waste in workplace	Slides Textbooks		and disposing of waste in workplace	Disposal bin PPE

GENERAL OBJECTIVE 4.0: Know the safety of farm facilities and equipment						
11-13	4.1 Explain farm facilities and equipment 4.2 Explain the safety of farm facilities and equipment: • Tillage • Planting • Crop Protection • Harvesting • Post Harvesting	Explain farm facilities and equipment Explain the safety of farm facilities and equipment: • Tillage • Planting • Crop Protection • Harvesting • Post Harvesting	Safety posters Whiteboard Projector Marker Computer Internet Slides Textbooks	Visit a storage/processing facilities Show video presentation of farm implements repairs/maintenance	Guide students to: Visit a storage/ processing facilities Show video presentation of farm implements repairs/ maintenance	Charts Pictorials Posters Television Video Player

	ASSESSMENT CRITERIA			
	Coursework	Course Test 20%	Practical 60%	Other: Examination/Project 20%

PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE		
MODULE: USE OF WORKSHOP TOOLS AND EQUIPMENT	**SUBJECT CODE:** CAM 112	**CONTACT HOURS:**
YEAR: 1 **TERM:** 1	**PRE: REQUISITE:**	**THEORETICAL:**
		PRACTICAL:
GOAL: This module is designed to introduce the trainee with knowledge of basic workshop tools, equipment and infrastructure.		
GENERAL OBJECTIVE: On completion of this module, the trainee should be able to: 1.0 Understand basic hand tools and equipment that are appropriate to a specific task 2.0 Understand the operation, care and storage of basic tools and equipment 3.0 Understand the basic safety procedures and practices as well as good practices regarding the use and storage. 4.0 Understand the culture of maintenance and care for both the environment, infrastructure and operations		

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN ENGINEERING CRAFT PRACTICE						
MODULE: USE OF WORKSHOP TOOLS AND EQUIPMENT			**SUBJECT CODE:** CAM 112		**CONTACT HOURS:** 84 **THEORETICAL:** 36 HOURS	
YEAR: 1 **TERM:** 2			**PRE: REQUISITE:**		**PRACTICAL:** 48 HOURS	
GOAL: This module is designed to introduce the trainee with knowledge of basic workshop tools, equipment and infrastructure						
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
GENERAL OBJECTIVE 1.0: Understand basic hand tools and equipment that are appropriate to a specific task						
WEEK	**SPECIFIC LEARNING OUTCOME**	**TEACHER'S ACTIVITIES**	**RESOURCES**	**SPECIFIC LEARNING OUTCOME**	**TEACHER'S ACTIVITIES**	**RESOURCES**
1	1.1 Define workshop hand tool and equipment. 1.2 Describe how to select tools for a particular task 1.3 Describe how to use appropriate hand tool and equipment 1.4 Describe basic hand tool and their importance: • Screwdrivers • Hammers • Wrenches • Pliers • Chisels • Hand saws • Measuring tools etc. 1.5 Describe power tools and their significance:	Explain workshop hand tool and equipment. Explain how to select tools for a particular task Explain how to use appropriate hand tool and equipment Explain basic hand tool and their importance: • Screwdrivers • Hammers • Wrenches • Pliers • Chisels • Hand saws • Measuring tools etc.	Whiteboard Projector Marker Computer Internet Slides Textbooks	Identify workshop hand tool and equipment. Identify how to select tools for a particular task Identify how to use appropriate hand tool and equipment Identify basic hand tool and their importance Identify power tools and their significance Identify special tools and how to use them	Guide trainees to: Identify workshop hand tool and equipment. Identify how to select tools for a particular task Identify how to use appropriate hand tool and equipment Identify basic hand tool and their importance Identify power tools and their significance Identify special tools and how to use them	Screwdrivers Hammers Wrenches Pliers Chisels Hand saws Measuring tools Circular saws Drills, sanders Power routers Jigsaws Power nailers Welding equipment

	• Circular saws • Drills • Sanders • Power routers • Jigsaws • Power nailers etc. 1.6 Describe special tools and how to use them: • Welding equipment • Woodworking planes • Pipe cutters • Paint sprayers etc.	Explain power tools and their significance: • Circular saws • Drills • Sanders • Power routers • Jigsaws • Power nailers etc. Explain special tools and how to use: • Welding equipment • Woodworking planes • Pipe cutters • Paint sprayers etc.				Woodworking planes

GENERAL OBJECTIVE 2.0: Understand the operation, care and storage of basic tools and equipment						
	2.1 Describe how to organize and store your workshop tools through planning your workshop: • Assessing space • Workstation placement • Tool accessibility • Safety considerations	Explain how to organize and store your workshop tools through planning your workshop: • Assessing space • Workstation placement • Tool accessibility • Safety considerations	Whiteboard Projector Marker Computer Internet Slides Textbooks	Identify how to organize and store your workshop tools Identify storage solutions for tools • Tool cabinet • Wall mounted storage • Toolboxes and totes • Tool foam inserts	Guide trainees to: Identify how to organize and store your workshop tools Identify storage solutions for tools • Tool cabinet • Wall mounted storage • Toolboxes and totes	Tool cabinet Wall mounted storage Toolboxes Totes Tool foam inserts

	2.2 Describe storage solutions for tools: • Tool cabinet • Wall mounted storage • Toolboxes and totes • Tool foam inserts	Explain storage solutions for tools • Tool cabinet • Wall mounted storage • Toolboxes and totes • Tool foam inserts			• Tool foam inserts	

GENERAL OBJECTIVE 3.0: Understand the basic safety procedures and good practices.						
	4.1 Define safety procedures 4.2 Describe personal protective equipment • Eye protection • Hearing protection • Respiratory protection • Hand protection • Foot protection • Clothing 4.3 Describe tools maintenance and care • Regular inspections • Proper tool storage • Maintenance and lubrication • Sharp and clean tools • Machinery guarding	Explain safety procedures Explain personal protective equipment • Eye protection • Hearing protection • Respiratory protection • Hand protection • Foot protection • Clothing Explain tools maintenance and care • Regular inspections • Proper tool storage • Maintenance and lubrication • Sharp and clean tools	Whiteboard Projector Marker Computer Internet Slides Textbooks	Identify personal protective equipment Identify tools maintenance and care	Guide trainees to: Identify personal protective equipment Identify tools maintenance and care	PPE HSE

		• Machinery guarding				

GENERAL OBJECTIVE 4.0: Understand the culture of maintenance and care for both the environment, infrastructure and operations						
	5.1 Describe Workshop safety guidelines: • Familiarize yourself with tools • Proper tool use • Workspace organization • Electrical safety • Fire safety • Tool handling 5.2 Describe ways of keeping the workshop clean and tidy • Regular cleaning • Waste management • Material storage • Cable management	Explain Workshop safety guidelines: • Familiarize yourself with tools • Proper tool use • Workspace organization • Electrical safety • Fire safety • Tool handling Explain ways of keeping the workshop clean and tidy • Regular cleaning • Waste management • Material storage • Cable management	Whiteboard Projector Marker Computer Internet Slides Textbooks	Identify Workshop safety guidelines Identify ways of keeping the workshop clean and tidy	Guide trainee to: Identify Workshop safety guidelines Identify ways of keeping the workshop clean and tidy	HSE

Assessment profile: Practical to take 60% of overall assessment

<table>
<tr><td colspan="3">PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE</td></tr>
<tr><td>MODULE: BASIC AGRICULTURAL SCIENCE</td><td>SUBJECT CODE: CAM 113</td><td>CONTACT HOURS:</td></tr>
<tr><td>YEAR: 1 TERM: 1</td><td rowspan="2">PRE: REQUISITE:</td><td>THEORETICAL:</td></tr>
<tr><td></td><td>PRACTICAL:</td></tr>
<tr><td colspan="3">GOAL: This module is designed to provide trainee with knowledge of soil science, crop and animal husbandry.</td></tr>
<tr><td colspan="3">GENERAL OBJECTIVE: On completion of this module, the trainee should be able to:

1.0 Know soil formation and its properties.
2.0 Understand soils and their effects on agricultural implements.
3.0 Understand soil-crop relationship.
4.0 Understand plant growth and reproduction.
5.0 Know different species of animals and their maintenance requirements</td></tr>
</table>

PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE						
MODULE: BASIC AGRICULTURAL SCIENCE				**COURSE CODE:** CAM 113		**CONTACT HOURS:** 120
						THEORETICAL:
YEAR: 1 **TERM:** 1				**PRE: REQUISITE:**		**PRACTICAL:**
GOAL: This module is designed to provide trainee with knowledge of soil science, crop and animal husbandry.						
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
GENERAL OBJECTIVE 1.0: Know soil formation and its properties.						
WEEK	**SPECIFIC OBJECTIVES**	**TEACHER'S ACTIVITY**	**RESOURCES**	**SPECIFIC LEARNING OUTCOMES**	**TEACHER'S ACTIVITY**	**RESOURCES**
1-3	1.1 Define soil 1.2 Define rock 1.3 Define the following: • Parent rock • Sub soil • Top soil. 1.4 Define weathering 1.5 List the types of weathering 1.6 Explain the mechanics of weathering. 1.7 Understand soil structure and consistency.	Explain soil Explain rock Explain the following: • Parent rock • Sub soil • Top soil. Explain weathering Explain the types of weathering Explain the mechanics of weathering Explain soil structure and consistency	Marker/chalk, Whiteboard/blackboard, Charts, Projector, Computer, Internet, Textbooks, Slides	Identify types soil Identify rocks Identify Parent rock, Sub soil and Top soil. - Identify types of weathering Identify mechanics of weathering Identify soil structure and consistency Identify the following:	Guide trainees to: Recognize types of soil Recognize rocks Recognize Parent rock, Sub soil and Top soil. - Identify types of weathering Identify mechanics of weathering Recognize soil structure and consistency	Soil samples, Rocks, Shovels, Diggers, Sample bags

	1.8 Understand the following terms: • Soil aggregates • Soil water • Soil air • Soil micro-organisms • Organic matter.	Explain the following terms: • Soil aggregates • Soil water • Soil air • Soil micro-organisms • Organic matter.		• Soil aggregates • Soil water • Soil air • Soil micro-organisms • Organic matter	Recognize the following: • Soil aggregates • Soil water • Soil air • Soil micro-organisms • Organic matter	
GENERAL OBJECTIVE 2.0: Understand soils and their effects on agricultural implements						
4-5	2.1 Describe the classes of soil: • Clay loam • Silt soil • Sandy soil 2.2 Understand various types of agricultural implements 2.3 Discuss the effect of different types of soil on various types of agricultural implements and vice-versa. 2.4 Discuss the effect of organic matter on soil. 2.5 Discuss the effect of soil moisture on ploughing. 2.6 Describe the soil pH scale.	Explain the classes of soil: • Clay loam • Silt soil • Sandy soil Explain the various types of agricultural implements Explain the effect of different types of soil on various types of agricultural implements and vice-versa. Explain the effect of organic matter on soil Explain the effect of soil moisture on ploughing	Marker/chalk, Whiteboard /blackboard, Charts, Projector, Computer, Internet, Textbooks, Slides	Identify the classes of soil (clay loam, silt and sandy soil) using soil samples. Identify the various types of agricultural implements Identify the effect of different types of soil on various types of agricultural implements and vice-versa. Identify the effect of organic matter on soil Identify effects of soil moisture on ploughing	Guide trainees to: Recognize the classes of soil (clay loam, silt and sandy soil) using soil samples. Recognize the various types of agricultural implements Recognize the effect of different types of soil on various types of agricultural implements and vice-versa. Recognize the effect of organic matter on soil Perform effect soil moisture on ploughing	Soil samples, Tractor, plough, harrow, ridger, Soil pH scale, shovel, digger hoe.

		Explain the soil pH scale.		Carryout soil pH test	Perform soil pH test	
GENERAL OBJECTIVE 3.0: Understand soil-crop relationship						
6 -7	3.1 Describe seed germination. 3.2 Explain the requirements for seed germination. 3.3 Describe essential soil nutrients: • Micro nutrients • Macro nutrients 3.4 List the functions of the essential nutrients in the crop.	Explain seed germination Explain the requirements for seed germination. Explain the essential soil nutrients: • Micro nutrients • Macro nutrients Explain the functions of essential nutrients in the crop.	Marker Whiteboard Charts Projector Computer Internet Textbooks Slides	Carry out seed germination Identify requirements for seed germination. Identify the essential soil nutrients (micro and macro nutrients).	Guide trainees to: Carry out seed germination Identify Requirements for seed germination. Recognize the essential soil nutrients (micro and macro nutrients). -	Crop, seed, Flower, hoe
GENERAL OBJECTIVE 4.0: Understand plant growth and reproduction.						
7-9	4.1 Define photosynthesis and respiration 4.2 Describe the processes of photosynthesis and respiration 4.3Describe the functions of part s of a crop flower. 4.4 Describe the process of fertilization and fruits formation.	Explain photosynthesis and respiration Explain the processes of photosynthesis and respiration. Explain the functions of parts of a crop flower Explain fertilization and fruits formation.	Marker Whiteboard Charts Projector Computer Internet Textbooks Slides		Guide trainees to:	Crop, flowers, seedlings, hoe

GENERAL OBJECTIVE 5.0: Know different species of animals and their management requirements.						
10-13	5.1 Describe various species of animals and poultry birds. 5.2 Describe the economic importance of poultry birds: • Fowl • Turkey • Goat • Sheep • Rabbits • Pigs • Cattle. 5.3 Describe the stages of growth and feed requirements at each stage of poultry birds and animals listed in 5.2 above. 5.4 Describe the type of housing required for each of poultry birds and animals 5.5 Describe the different uses of equipment in poultry birds and animal houses.	Explain the various species of animals and poultry birds Explain the economic importance of poultry birds: • Fowl • Turkey • Goat • Sheep • Rabbits • Pigs • Cattle. • Explain the stages of growth and feed requirements at each stage of poultry birds and animals listed in 5.2 above. Explain the type of housing required for each of poultry birds and animals Describe the different uses of equipment in poultry birds and animal houses.	Marker/chalk Whiteboard/ Blackboard Charts Projector Computer Internet Textbooks Slides.	Identify poultry in a secluded animal grazing farms. Identify various species of animals and poultry birds Identify various type of housing required for each of poultry birds and animals Identify different equipment used for poultry birds and animal houses.	Guide trainees to: Visit poultry and secluded animal grazing farms. Recognize various species of animals and poultry birds Recognize type of housing required for each of poultry birds and animals Identify different poultry birds and animal houses.	Species of animals and poultry birds Houses for poultry birds and animals, Equipment used in different animal houses, Logs, woods, zinc, straws etc

	ASSESSMENT CRITERIA			
	Coursework	Course Test 20%	Practical 40%	Other: Examination/Project 40%

PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE		
MODULE: GENERAL METAL WORK I	**SUBJECT CODE:** CAM 121	**CONTACT HOURS:**
YEAR: 1 **TERM:** 2	**PRE: REQUISITE:**	**THEORETICAL:**
		PRACTICAL:
GOAL: This module is designed to equip the trainee with the knowledge and skills of general metal work processes		
GENERAL OBJECTIVE: On completion of this module, the trainee should be able to: 1.0 Understand ferrous and non-ferrous metals. 2.0 Know the selection of common measuring, marking out, cutting and striking tools. 3.0 Know the principles of drilling machine for various drilling operations. 4.0 Know the application of fastening tools in metal work processes. 5.0 Know the ISO system and their applications in engineering production. 6.0 Understand the essential features and working principles of the centre lathe.		

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN ENGINEERING CRAFT PRACTICE						
MODULE: GENERAL METAL WORK I			**COURSE CODE:** CAM 121		**CONTACT HOURS:** 84 **THEORETICAL:**36 HOURS	
YEAR: 1 **TERM:** 2			**PRE: REQUISITE:**		**PRACTICAL:** 48 HOURS	
GOAL: This module is designed to equip the trainee with the knowledge and skills of general metal work processes						
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
GENERAL OBJECTIVE 1.0: Understand ferrous and non-ferrous metals.						
WEEK	**SPECIFIC LEARNING OUTCOME**	**TEACHERS ACTIVITIES**	**RESOURCES**	**SPECIFIC LEARNING OBJECTIVES**	**TEACHERS ACTIVITIES**	**RESOURCES**
1-3	1.1. Define metal 1.2. Discuss the following general physical properties of metals:- • Ductility • Malleability • Strength • Toughness • Brittleness • Elasticity • Plasticity 1.3 Define ferrous metals 1.4 Describe the application of ferrous metals 1.5 Define non-ferrous metals	Explain metal Explain the following general physical properties of metals: • Ductility • Malleability • Strength • Toughness • Brittleness • Elasticity • Plasticity Explain ferrous metals Explain the application of ferrous metals Explain non-ferrous metals	Marker White Board Smart board Textbooks Slides Diagrams Projector Computer Internet Charts Video player .	Identify metals Identify general physical properties of metals Identify basic properties of carbon steels, cast iron and alloy steel	Guide student to: Identify metals Recognize general physical properties of metals Recognize basic properties of carbon steels, cast iron and alloy steel	Cupola furnace, PPE, Plain carbon steels, Cast iron, Alloy steel, Copper, Tin, Zinc, Aluminium alloys, Brass metal

	1.6 Describe the applications of non-ferrous metals: • Copper • Tin • Zinc • Aluminum • Aluminium alloys • Brass metal • Cartridge brass gilding metal etc.	Explain the applications of non-ferrous metals: • Copper • Tin • Zinc • Aluminum • Aluminium alloys • Brass metal • Cartridge brass gilding metal etc.		Select non-ferrous metals	Identify non – ferrous metals	
	1.7. Discuss the basic properties of: • Plain carbon steels • Cast iron • Alloy steel	Explain the basic composition and properties of: • Plain carbon steels • Cast iron • Alloy steel		Identify properties of plain carbon steels, cast iron and alloy steel	Carry out test of plain carbon steels, cast iron and alloy steel	
	1.8 State the application of 1.7 above in fabrication	Explain the application of 1.7 above in fabrication and welding		Identify application of plain carbon steels, cast iron and alloy steel in fabrication and welding	Carryout application of plain carbon steels, cast iron and alloy steel in fabrication and welding	
	1.9 Discuss cupola process	Explain Cupola process		Know the cupola process Know the cupola process of manufacturing cast iron	Carryout the cupola process	

	1.10 Describe the cupola process of manufacturing cast iron: • The blast furnace process of manufacture of pig iron • The direct reduction process of manufacture of steel	Explain the cupola process of manufacturing cast iron: • The blast furnace process of manufacture of pig iron • The direct reduction process of manufacture of steel			Field trip to a steel manufacturing plant	
GENERAL OBJECTIVE 2.0: Know the selection of common measuring, marking out, cutting and striking tools.						
3- 5	2.1 Define measuring Instrument 2.2 Explain the following: • Common measuring • Marking out • Cutting • Striking tools. 2.3 Discuss the differences between "line" and "end" measurement. 2.4 Explain the use of datum points, datum lines and datum faces in marking out. 2.5 Describe the functions of the following marking out tools: • Steel rule	Explain measuring instruments Explain the following • Common measuring • Marking out • Cutting • Striking tools Explain the differences between "line" and "end" measurement. Explain the use of datum points, datum lines, and datum faces in marking out. Explain the functions of the following marking out tools:	Diagrams Charts Video player Marker White Board Smart board Computer Internet Projector Textbooks Slides	Identify common measuring tools Identify difference between “line” and “end” measurement Identify the use of datum points, datum lines and datum faces in marking out. Identify steel rule, dividers, caliphers, scribers etc.	Guide student to: Identify common measuring tools Identify difference between “line” and “end” measurement Carryout the use of datum points, datum lines and datum faces in marking out. Carry out marking out using steel rule, dividers, calipers, scribers etc.	Micrometer,vernier caliper, Vernier height, gauge, Steel rules, Dividers Punches , Trammel, Scribers, Angle plate, Vee block , Center square, Flat file, Try square, Hacksaw, Adjustable hacksaw,

	• Dividers • Calipers (inside, outside and odd-legs) • Trammel • Scriber • Angle plate • Vee-block • Centre square 2.5 Define File tool 2.6 Describe the various types of files 2.7. Discuss the applications of files 2.8 Classify the common files used in metal work 2.9 Describe a bench vice 2.10 Explain the function of a bench vice 2.11 Describe bench vice clamping power 2.12 Describe the technique of holding work on the vice for filing and tapping operations.	• Steel rule • Dividers • Calipers (inside, outside and odd-legs) • Trammel • Scriber • angle plate • Vee-block • Centre square. Explain file tools Explain the various types of files Explain the application of files Explain common files used in metal work Explain a bench vice Explain the function of a bench vice Explain bench vice clamping power		Identify file tool Identify types of files Identify common files for metal work Identify filing operations Identify functions of a vice Identify various parts of bench vice Use bench vice clamping Demonstrate working on the vice for filling and tapping operations	Recognize file tool Identify the types of files Carry out filling operations using common file for metal work Perform filing operations Recognize bench vice Identify various parts of bench vice Carry out bench vice clamping Perform holding work on the vice for filling and tapping operations	Bench vice

	2.13 Describe the following tools: • Cold chisels (flat, cross, cut half round, diamond-point) • Centre punch and dot punch • Scrapers (flat, triangular, half round) • Power hack saw 2.14 State the safety precautions to be observed when using a hand tools	Explain the technique of holding work on the vice for filing, and tapping operations Explain the following: • Cold chisels (flat, cross, cut half round, diamond-point) • Centre punch and dot punch • Scrapers (flat, triangular, half round) • Power hack saw Explain the safety precautions to be observed when using a hand hacksaw		Identify the following working tools: • Cold chisels (flat, cross, cut half round, diamond-point) • Centre punch and dot punch • Scrapers (flat, triangular, half round) • Power hack saw Demonstrate the safety precautions to be observed when using a hand hacksaw	Carryout work using hand hacksaw while observing safety precautions	

GENERAL OBJECTIVE 3.0: Know the principles of drilling machine for various drilling operations						
5-7	3.1 Define drilling machine 3.2 Describe the various types of drilling machines. 3.3 Discuss the main features of a bench or pillar drilling machine.	Explain drilling machine Explain the various types of drilling machines Explain the main features of a bench or pillar drilling machine	Diagrams Video player Marker/chalk White Board/blackboard Smart board Computer Internet	Identify different types of drilling machines	Guide student to: Distinguish different types of drilling machines	Bench drill, Pillar drill, Drill bits, Center drill, Marking out tools, PPE,

	3.4 Define drill bit 3.5 Describe the use of the following drill bits: • Twist drill (taper shank, parallel shank) • Jobbers drill • Flat drill • Countersink drill • Counter bore drill • Combination centre drill. 3.6 Explain faults in a ground twist drill bit: • Too acute point angle • Too obtuse point • Unequal cutting edges • Insufficient lip clearance • Excessive lip clearance. 3.7 Explain how to calculate spindle revolution or cutting speed for specified size of drill using the formulae:- N = 1000S/πd S = πdN/1000	Explain drill bit Explain the use of following drill bits: • Twist drill (taper shank, parallel shank) • Jobbers drill • Flat drill • Countersink drill • Counter bore drill • Combination centre drill. Explain the faults in a ground twist drill bit as in 3.6 Explain how to calculate spindle revolution or cutting speed for specified size of drill using the formulae:- N = 1000S/πd S = πdN/1000	Projector Textbooks Slides	Identify the main features of bench or pillar drilling machine Identify the following: • Twist drill (taper shank, parallel shank) • Jobbers drill • Flat drill • Countersink drill • Counter bore drill • Combination centre drill. Identify the effects of following faults in a ground twist drill as in 3.6 Know spindle revolution or cutting speed for specified size of drill using the formulae:- N = 1000S/πd S = πdN/1000	Sketch the main features of bench or pillar drilling machine Draw and label: • Twist drill (taper shank, parallel shank) • Jobbers drill • Flat drill • Countersink drill • Counter bore drill • Combination centre drill. Identify the effects of following faults in a ground twist drill as in 3.6 Calculate spindle revolution or cutting speed for specified size of drill using the formulae:- N = 1000S/πd	Reaming tool Scientific Calculator

	Where S = cutting speed (m/min) N = revolutions/minute D = diameter of drill (mm) π = 3.142	Where S = cutting speed (m/min) N = revolutions/minute D = diameter of drill (mm) π = 3.142		Where S = cutting speed (m/min) N = revolutions/minute D = diameter of drill (mm) π = 3.142	S = πdN/1000 Where S = cutting speed (m/min) N = revolutions/minute D = diameter of drill (mm) π = 3.142	
	3.8 Explain the causes of drilling faults such as:- • Drill breaking • Drill coloured blue • Walls of drilled hole left rough • Chipped cutting lips.	Explain the causes of drilling faults such as:- • Drill breaking • Drill coloured blue • Walls of drilled hole left rough • Chipped cutting lips.		Know the causes of drilling faults such as:- • Drill breaking • Drill coloured blue • Walls of drilled hole left rough • Chipped cutting lips	Recognize drilling bits faults such as in 3.8	
	3.9 Explain safety precautions to be observed when using a drilling machine.	Explain safety precautions to be observed when using a drilling machine.		Know safety precautions to be observed when using a drilling machine.	Observer safety precaution using PPE safe operation of drilling machine	
	3.10 Describe reaming operation	Explain reaming operation		Know reaming activities	Perform reaming operations	
	3.11 Explain the purpose of reaming	Explain the purpose of reaming				

	3.12 Describe different types of hand and machine reamers.	Explain different types of hand and machine reamers.		Know different types of hand and machine reamers	Identify different types of hand and machine reamers	

GENERAL OBJECTIVE 4.0 Know the application of fastening tools in metal work processes						
7 -9	4.1 Define thread 4.2 Explain thread forms and their applications:- • the ISO metric thread • the unified thread • Whitworth and British fine threads • British Association (BA) thread • British Standard pipe • Square thread • Acme thread • Buttress thread. 4.3 Define tap 4.4. Describe the functions of: • Taps (taper tap, second tap, plug) • Tap wrench • Die and die stock. 4.5 Explain tap size and estimate its value in given	Explain thread Explain thread forms and their applications: • the ISO metric thread • the unified thread • Whitworth and British fine threads • British Association (BA) thread • British Standard pipe • Square thread • Acme thread • Buttress thread. Explain tap Explain the functions of: • Taps (taper tap, second tap, plug) • Tap wrench • Die and die stock	Diagrams Video player Marker White Board Smart board Computer Internet Projector Textbooks Slides	Identify thread forms and their applications Identify the functions of:- • Taps (taper tap, second tap, plug) • Tap wrench • Die and die stock.	Guide student to: Identify thread forms and their applications Perform tapping operations using tap as in 4.4	Samples of threads, Taps, Die & stock, Tap wrench, Rivets, Vernier caliper, Micrometer screw gauge, Steel rule, PPE,

	situations using formulae such as: T = D - P Where: T = tapping diameter D = thread top diameter P = pitch 4.6 Describe precautions taken during taping operation 4.7. Define rivet 4.8 Describe types of rivets. • Snap and pan head • Mushroom and counter-sunk head • Flat head • Dod rivet etc. 4.9 Describe the rivet set 4.10 Determine the diameter of rivet and riveting allowance in given situations.	Explain tap size and estimate its value in given situations using formulae such as: T = D - P Where: T = tapping diameter D = thread top diameter P = pitch Explain precautions to be taken when taping on the bench. Explain rivet Explain types of rivets: • Snap and pan head • Mushroom and counter-sunk head • Flat head • Dod rivet etc. Explain the rivet set Explain the diameter of rivet and riveting allowance in a given situations.		Know how to estimate tapping diameter of a tapping drill Identify precautions taken during taping operations Identify types of rivets Draw a rivet and calculate the diameter of rivet and riveting allowance in a given situations using the formula: T = D – P	Know how to estimate tapping diameter of a tapping drill Perform taping operations while observing safety precaution Recognize types of rivets Sketch a rivet Draw a rivet and calculate the diameter of rivet and riveting allowance in a given situations using the formula: T=D-P	

GENERAL OBJECTIVE 5.0: know the ISO system and their applications in Engineering production.						
9 -10	5.1 Discuss ISO system of limits and tolerances 5.2 Discuss the following: • Nominal size • Limits (upper and lower) • Tolerance (unilateral and bilateral) • Fit (clearance, transition interference). 5.3 Discuss the importance of tolerance and fit in engineering production 5.4 Determine by calculation the amount of tolerance and types of fit in given situations.	Explain ISO system of limits and tolerances Explain the following: • Nominal size • Limits (upper and lower) • Tolerance (unilateral and bilateral) • Fit (clearance, transition interference). Explain the importance of tolerance and fits in engineering production Explain by calculation the amount of tolerance and types of fits in given situations.	Diagrams Video player Marker/chalk White Board/blackboard Smart board Computer Internet Projector Textbooks Slides	Identify between nominal size, limits, tolerance and fits. Identify with calculations the amount of tolerance and types of fits in given situations.	GUIDE student to: Identify between nominal size, limits, tolerance and fits. calculate the amount of tolerance and types of fits in given situations.	Samples metal products Vernier caliper (external and internal) Micrometer screw gauge

GENERAL OBJECTIVE 6.0: Understand the essential features and working principles of the centre lathe.						
10-12	6.1 Define lathe machine 6.2 Describe the essential features of a centre lathe e.g.: • Lathe bed • Headstock • Tailstock • Saddle or carriage, etc. 6.3 Describe the working principles of the centre lathe. 6.4 Discuss the lathe accessories: • Catch or driving plate • Face plate • Lathe dog or carrier • Lathe centres • Fixed steadies • Travelling steadies.	Explain lathe machine Explain the essential features of a centre lathe e.g.: • Lathe bed • Headstock • Tailstock • Saddle or carriage,etc. Explain the working principles of the centre lathe Explain the lathe accessories: • Catch or driving plate • Face plate • Lathe dog or carrier • Lathe centres • Fixed steadies • Travelling steadies.	Diagrams Video player Marker/chalk White Board/blackboard Smart board Computer Internet Projector Textbooks Slides	Identify the essential features of a centre lathe Identify lathe accessories	Recognize the essential features of a centre lathe Recognize lathe accessories	Point tools Grinding machine Lathe machine 3-jaw chuck and lathe machine and accessories Catch plate, Face plate, Dog lathe, Lathe centers Fixed stead Travelling steadies Round nose turning tool Fine finishing tool

	6.5 Describe the functions of centre lathe accessories 6.6 Describe the difference between the centre lathe and capstan lathe 6.7 Describe types of cutting fluids used for lathe turning. 6.8 Describe safety precautions to be observed when working on the lathe 6.9 Describe the machining tools: e.g.: • Butt-brazed tool • Tipped tool • Bit • Holder. 6.10 Differentiate between various tool shapes e.g.: • Round nose rougher • Fine finishing • Side finishing • Knife tool • Form tool • Parting off tool	Explain the functions of centre lathe accessories Explain the difference between the centre lathe and capstan lathe Explain types of cutting fluids used for lathe turning Explain safety precautions to be observed when working on the lathe Explain machining tools: e.g: • Butt-brazed tool • Tipped tool • Bit • Holder. • Explain various tool shapes and state their uses e.g.: • Round nose rougher • Fine finishing • Side finishing • Knife tool • Form tool • Parting off tool		Identify types of cutting fluids used for lathe turning. Know safety precautions to be observed when working on the lathe Identify with sketch common machining tools Identify with sketches of tool angles (rake, clearance)	Identify types of cutting fluids used for lathe turning Perform work on the lathe while observing safety precautions Recognize common machining tools by sketching Sketch the tool angles (rake, clearance) Identify various tool shapes	Form tool Parting off tool Boring tool Bar of good length Live/dead centers Site finishing Knife tools Cutting fluid

	• Boring tool, etc. 6.11 Describe the effects of wrong cutting tools setting: e.g.: • Vibration and chatter, • Tool rubbing against or digging into the job. 6.12 Discuss the cutting speed and feed with respect to lathe operation.	• Boring tool, etc Explain the effects of wrong setting cutting tools e.g.: • Vibration and chatter, • Tool rubbing against or digging into the job. Explain the cutting speed and feed with respect to lathe operation.		Know the cutting speed and feed for given turning operation: • The rate of metal removal • Time required for carrying out specified turning operations	Calculate the cutting speed and feed for given turning operation: • The rate of metal removal • Time required for carrying out operations	

	ASSESSMENT CRITERIA			
	Coursework	Course Test 20%	Practical 40%	Other: Examination/Project 40%

PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE		
MODULE: MATERIAL AND WORKSHOP PROCESSES	**SUBJECT CODE:** CAM 122	**CONTACT HOURS:**
YEAR: 1 **TERM:** 2	**PRE: REQUISITE:**	**THEORETICAL:**
		PRACTICAL:
GOAL: This module is designed to provide the trainee with relevant knowledge of workshop tools and materials		
GENERAL OBJECTIVE: On completion of this module, the trainee should be able to: 1.0 Understand the importance safety at work environment 2.0 Know the properties metals and non-metals, their uses, advantages and limitations. 3.0 Carryout storage of tools used for the repairs of agricultural equipment. 4.0 Know sheet metal and care of tools used in sheet metal works. 5.0 Understand the principles of welding and fabrications.		

PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE						
MODULE: MATERIAL AND WORKSHOP PROCESSES			**COURSE CODE:** CAM 122		**CREDIT HOURS:** 192 **THEORETICAL:**	
YEAR: 1 **TERM:** 2			**PRE: REQUISITE:**		**PRACTICAL:**	
GOAL: This module is designed to provide the trainee with relevant knowledge of workshop tools and materials						
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
GENERAL OBJECTIVE 1.0: Understand the importance safety at work environment						
WEEK	**SPECIFIC LEARNING OUTCOME**	**TEACHERS ACTIVITIES**	**RESOURCES**	**SPECIFIC LEARNING OBJECTIVES**	**TEACHERS ACTIVITIES**	**RESOURCES**
1-2	1.1 Define safety precaution 1.2 List sources of hazards in the workshop: • Obstructions left on the floor and benches • Loose fitting clothing • Using inflammable or corrosive liquid or gases etc. 1.3 Describe first aid applications in case of minor injuries, electric shocks and burns. 1.4 Explain artificial respiration	Explain safety precaution. Explain sources of hazards in the workshop as in 1.2 Explain first aid applications in case of minor injuries, electric shocks and burns. Explain artificial respiration.	Marker/ chalk White Board/ black board Textbooks Projector Computer Internet Slides Diagrams Charts	Identify sources of hazards in the workshop Discuss artificial respiration	Guide trainees to: Recognize sources of hazards in the workshop Demonstrate artificial respiration using dummy	PPE First Aid box Bins

GENERAL OBJECTIVE 2.0: Understand the properties of different types of metals and non-metals, their uses, advantages and limitations.						
3-4	2.1 Describe the properties of all types of metals used in agricultural equipment:	Explain the properties of all types of metals used in agricultural equipment:	Marker White Board Textbooks	Know the properties of all types of metals	Guide trainees to: Identify the properties of all types of metals	Round bar metal

	2.2 Explain the properties and uses of all types of alloys. 2.3 State the advantages and limitations of special steels and other alloys. 2.4 Explain the causes and effects of corrosion of metals and prevent it by applying protective measures such as: • Inhibition • Surface treatment • Protection films. 2.5 Describe ways of identification of metals by sound test, appearance, spark test and any other quick test. 2.6 Describe cold and hot working operations: • Bending • Twisting • Straightening. 2.7 Describe the heat treatment of metals: • Annealing of aluminum and case hardening of low	Explain the properties and uses of all types of alloys. Explain the advantages and limitations of special steels and other alloys Explain the causes and effects of corrosion of metals and prevent it by applying protective measures such as: • Inhibition • Surface treatment • Protection films. Explain ways of identifying metals by sound test, appearance, spark test and any other quick test. Explain cold and hot working operations: • Bending • Twisting • Straightening. Explain the process of heat treatment of metals as describe in 2.7	Projector Computer Internet Slides Diagrams Charts	Identify the uses of all types of alloys. Identify the causes and effects of corrosion of metals and prevent it by applying protective measures Identify metals by sound test, appearance, spark test and any other quick test. Identify cold and hot working operations through bending, twisting, and straightening. Know process of heat treatment of metals through annealing and tempering	Identify the uses of all types of alloys. Identify the causes and effects of corrosion of metals and prevent it by applying protective measures protective measures Carryout metals test through sound, appearance, spark and any other quick test. carryout bending, twisting, and straightening to identify cold and hot working operations Perform heat treatment of metals through annealing and tempering	Alloy materials Hammers Vice Furnace PPE

	carbon (mild) steel hardening • Tempering normalizing of carbon steel.					

GENERAL OBJECTIVE 3.0: Carry out storage of tools used for the repairs of agricultural equipment.						
5-6	3.1 Describe the use and maintenance of common tools used for typical repair and maintenance work: • Spanners • Screw driver • Drills • Reamers • Taps and dies • Files • Saws • Chisels • Taps and pinches. 3.2 Describe the care of measuring instruments: • Steel roll • Calipers • Dividers • Square • Straight edge • Protractors • Angle gauge • Thickness gauge • Micro meter. 3.3 Describe the care of:	Explain the use and maintenance of common tools used for typical repair and maintenance work: • Spanners • Screw driver • Drills • Reamers • Taps and dies • Files • Saws • Chisels • Taps and pinches. . Explain the importance of care of measuring instruments: • Steel roll • Calipers • Dividers • Square • Straight edge • Protractors • Angle gauge • Thickness gauge • Micro meter. Explain the care of: • Pullers	Tools rack Charts Marker White Board Textbooks, Projector Slides Diagrams Charts	Identify the various tools used and their maintenance. Know the importance of care of measuring instruments Identify the care of: • Pullers • Hydraulic press	Guide trainees to: Recognize various tools used for typical repairs Carryout cleaning and storing of measuring instruments Perform care of: • Pullers	Tool Boxes Steel Roll Calipers Dividers Square Straight Edge Protractors, Angle Gauge Hydraulic Press Cranes PPE

	• Pullers • Hydraulic press • Different types of jacking and lifting equipment cranes • Hydraulic jack • Hoists and slings.	• Hydraulic press • Different types of jacking and lifting equipment cranes • Hydraulic jack • Hoists and slings.		• Different types of jacking and lifting equipment cranes • Hydraulic jack • Hoists and slings.	• Hydraulic press • Different types of jacking and lifting equipment cranes • Hydraulic jack • Hoists and slings.	

GENERAL OBJECTIVE 4.0: Know different types of sheet metal and care of tools used in sheet metal works.						
7-9	4.1 Describe the use of various types of sheet metals: • Brass sheets • Copper sheets • Aluminum sheets etc. 4.2 Describe the use of sheet metal tools: • Mallet • Snipes • Grovers • Lappers • Swages • Hammer • Riveting tools etc. 4.3 Explain the preparation of sheet metals for: • Welding • Soldering • Riveting, etc. 4.4 Describe the construction of simple items:	Explain the use of various types of sheet metals: • Brass sheets • Copper sheets • Aluminum sheets etc. Explain the use of sheet metal tools: • Mallet • Snipes • Grovers • Lappers • Swages • Hammer • Riveting tools etc. Explain the preparation of sheet metals for: • Welding • Soldering • Riveting, etc. Explain the construction of simple items:	Charts Marker/ chalk White Board/blackboard Textbooks Projector Slides Diagrams	Know use and care of various types of sheet metals Identify use of sheet metal tools Identify sheet metals for: • Welding • Soldering • Riveting Know the construction of simple items such as:	Guide trainees to: Identify use of sheet metal tools Perform sheet metals Welding, Soldering and Riveting	Sheet metals Waste cloth Hammers Mallet Snipes Govers Lappers Swages Riveting Tools Work Bench PPE

	• Guards and trays from • Sheet materials.	• Guards and trays from • Sheet materials.		• Guards • Trays	Construct simple items such as: • Guards • Trays	

GENERAL OBJECTIVE 5.0: Understand the principles of welding and fabrications.						
10-12	5.1 Describe different types of soldering iron use in mechanical and electrical work: • Electrical solders • Brazing rods • Welding rods • Fluxes in common 5.2 Describe the setup of welding equipment for welds of different types of metals: • Selecting gas pressure • Nozzle sizes 5.3 Describe the basic principle of oxyacetylene welding 5.4 Describe the use of bronze brazing for repair work and build worn parts.	Explain different types of soldering iron use in mechanical and electrical work: • Electrical solders • Brazing rods • Welding rods • Fluxes in common Explain the setup of welding equipment for welds of different types of metals: • Selecting gas pressure • Nozzle sizes . Explain the basic principle of oxyacetylene welding Explain the use of bronze brazing for repair work and build worn parts.	Charts Marker White Board Textbooks Projector Slides Diagrams	Know the different types of soldering iron. Identify the setting up of welding equipment. know the basic principle of oxyacetylene welding Know the use of bronze for brazing for repair work and build worn parts. Know the use of oxy-acetylene flame to cut metal.	Guide trainees to: Identify the different types of soldering iron Carryout the setting up of welding equipment. Identify the basic principle of oxyacetylene welding Carryout brazing for repair work and build worn parts. Perform cutting operation using oxy-acetylene flame	Manual arc welding machine, Electrodes, AC, DC welding machine, Oxy-acetylene, welding cylinder and regulators Forging tools, Hammers, PPE, Soldering Iron

	5.5 Describe the use of oxy-acetylene flame to cut metal. 5.6 Describe the principle of arc welding voltage 5.7 Describe the common welding of mild steel cast etc. 5.8 Describe the effect of inadequate penetrating slag inclusion when welding and be able to correct it. 5.9 Describe the difference between AC and DC welding systems and be able to apply them safely 5.10 Describe the advantages and disadvantages of oxy-acetylene welding process on agricultural repairs. 5.11 Describe the application of hard surfacing rod by oxy-acetylene arc process for filling worn part and surface. 5.12 Describe forging tools	Explain the use of oxy-acetylene flame to cut metal. Explain the principle of arc welding voltage. Explain common welding of mild steel cast etc. Explain the effect of inadequate penetrating slag inclusion when welding. Explain Difference between AC and DC welding systems Explain the advantages and disadvantages of oxy-acetylene welding process on agricultural repairs. Explain the application of hard surfacing rod by oxy-acetylene arc process for filling worn part and surface. Explain forging tools		Know common welding of mild steel cast Identify difference between AC and DC welding systems Identify forging tools	Perform welding of mild steel cast Recognize difference between AC and DC welding systems Recognize forging tools	

	ASSESSMENT CRITERIA			
	Coursework	Course Test 20%	Practical 40%	Other: Examination/Project 40%

PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE		
MODULE: INTRODUCTION TO AGRICULTURAL MECHANIZATION	**SUBJECT CODE:** CAM 123	**CONTACT HOURS:**
YEAR: 1 **TERM:** 2	**PRE: REQUISITE:**	**THEORETICAL:**
		PRACTICAL:
GOAL: This module is designed to provide the trainee with the knowledge and skills of agricultural Mechanization		
GENERAL OBJECTIVE: On completion of this module, the trainee should be able to: 1.0 Understand farm mechanization 2.0 Know the uses of simple machines 3.0 Know machinery used for tillage operations 4.0 Know machinery for planting operations 5.0 Understand management and operating principles of farm machinery		

PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE						
MODULE: INTRODUCTION TO AGRICULTURAL MECHANIZATION		**COURSE CODE:** CAM 123		**CONTACT HOURS:** 120		
				THEORETICAL: 48 HOURS		
YEAR: 1 **TERM:** 2		**PRE: REQUISITE:**		**PRACTICAL:** 72 HOURS		
GOAL: This module is designed to provide the trainee with the knowledge and skills of agricultural Mechanization						
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
GENERAL OBJECTIVE 1.0: Understand farm mechanization						
WEEK	**SPECIFIC LEARNING OUTCOME**	**TEACHERS ACTIVITIES**	**RESOURCES**	**SPECIFIC LEARNING OBJECTIVES**	**TEACHERS ACTIVITIES**	**RESOURCES**
1	1.1 Trace the history of mechanized agriculture. 1.2 State the advantages of mechanized agriculture. 1.3 List the problems facing mechanized agriculture in Nigeria. 1.4 Understand Federal Government Policy on mechanized agriculture.	**E**xplain the history of mechanized agriculture. Explain the advantages of mechanized agriculture Explain the problems facing mechanized agriculture in Nigeria Explain in simple terms the Federal Government Policy on mechanized agriculture.	Marker, Chalk, Balck board, White board, Charts, Projector, Computer, Internet, Textbooks, Slides,			

GENERAL OBJECTIVE 2.0: know the uses of simple machines						
2-3	2.1 Define simple machine 2.2 Describe simple machine • The lever • The pulley system • The wheel and axle • The inclined plane • The screw and gears • The wedge 2.3 Describe properties of simple machines in 2.2 2.4 Discuss application of simple machine to agriculture	Explain simple machine Explain simple machine • The lever • The pulley system • The wheel and axle • The inclined plane • The screw and gears • The wedge Explain properties of simple machines Explain application of simple machine to agriculture	Marker White board Charts Projector Computer Internet Textbooks Slides	Discuss simple basic machine Identify properties of simple machines Know the use of simple machines	Guide trainees to: Identify simple basic machines Recognize properties of simple machines How to use simple machines	Pulley Wheel Axle Scree & gear Wedge Tractor Tillage machine Planters

GENERAL OBJECTIVE 3.0: know machinery used for tillage operations,						
4-5	3.1 Define tillage 3.2 Describe tillage operations • Primary tillage • Secondary tillage	Explain tillage Explain Primary tillage and Secondary tillage operations	Marker White board Charts Projector Computer Internet Textbooks	Know primary and secondary tillage operations.	Guide trainees to: Carry out primary and secondary tillage operations.	Tillage machin Tractor Power tiller Mouldboard plow

	3.3 Describe the purpose of tillage 3.4 Describe factors to consider when choosing tillage practices: • Soil type • Crop type • Climate conditions • Conservation concerns 3.5 Describe common tillage equipment • Mouldboard plough • Disc plough • Chisel plough • Cultivator • Harrow	Explain the purpose of tillage Explain factors to consider when choosing tillage practices: • Soil type • Crop type • Climate conditions • Conservation concerns Explain common tillage equipment • Mouldboard plough • Disc plough • Chisel plough • Cultivator • Harrow	Slides	Identify common tillage equipment	Recognize common tillage equipment	Disc plow Chisel plow Cultivator Harrow

GENERAL OBJECTIVE 4.0: Know machinery for planting operations						
6	4.1 Define planting 4.2 Describe planting machine 4.3 Describe planter classification	Explain planting process Explain planting machine	Marker White board Charts Projector Computer Internet Textbooks Slides	Identify planting machine	Guide trainees to: Recognize planting machine	Planters PPE Seed metering components Soil engaging components

	• Broadcasting • Dibbling • Drilling • Seed drilling behind a plough • Transplanting • Hill dropping • Checkrow planting 4.4 Describe planter component parts 4.5 Describe planter soil-engaging components 4.6 Describe planter seed metering components 4.7 Explain planter seed delivery components	Explain planter classification • Broadcasting • Dibbling • Drilling • Seed drilling behind a plough • Transplanting • Hill dropping • Checkrow planting Explain planter component parts Explain planter soil-engaging components Explain planter seed metering components Explain planter seed delivery components		Identify planter component parts Identify planter soil-engaging components Identify planter seed metering components Identify planter seed delivery components	Recognize planter component parts Recognize planter soil-engaging components Recognize planter seed metering components Recognize Planter seed delivery components	Tools Box

GENERAL OBJECTIVE 5.0: Understand management and operating principles of farm machinery						
7	5.1 Define farm management 5.2 Describe principles and functions of farm management 5.3 Describe common concepts and tools used in farm management 5.4 Explain machine management 5.5 Describe key principles in machine management • Selection and matching • Maintenance and care • Safe operation • Efficient operation • Economic considerations • Record keeping 5.6 Describe machine management phases and levels • Planning • Scheduling • Operating 5.7 Describe common preventive maintenance checks for : • Winterizing equipment • Checking and changing fluids	Explain farm management Explain principles and functions of farm management Explain common concepts and tools used in farm management Explain machine management Explain key principles in machine management: • Selection and matching • Maintenance and care • Safe operation • Efficient operation • Economic considerations • Record keeping Explain machine management phases and levels • Planning • Scheduling • Operating Explain common preventive maintenance checks for : • Winterizing equipment	Marker chalk White board Blackboard Charts Projector Computer Internet Textbooks Slides.	Identify common tools used in farm management Know common preventive maintenance checks	Guide trainees to: Recognize common tools used in farm management	PPE Farm tools box

	• Lubricating moving parts • Checking and changing filter • Examining the bearings • Calibrating equipment • Conducting damage inspections 5.8 Describe how to perform agricultural machineries maintenance safely. 5.9 Describe how to plan maintenance tasks in advance 5.10 Describe how to ensure machineries management using safety culture	• Checking and changing fluids • Lubricating moving parts • Checking and changing filter • Examining the bearings • Calibrating equipment • Conducting damage inspections Explain how to perform agricultural machineries maintenance safely Explain how to plan maintenance tasks in advance Explain how to ensure machineries management using safety culture		Observe safety precaution while maintaining agricultural machinery Discuss machinery management using safety culture	Carryout common preventive maintenance checks for maintenance Demonstrate safety precaution while maintaining agricultural machinery	

	ASSESSMENT CRITERIA			
	Coursework	Course Test 20%	Practical 40%	Other: Examination/Project 40%

<table>
<tr><td colspan="3">PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE</td></tr>
<tr><td>MODULE: INTRODUCTION TO TRACTOR</td><td>SUBJECT CODE: CAM 131</td><td>CONTACT HOURS:</td></tr>
<tr><td rowspan="2">YEAR: 1 TERM: 3</td><td rowspan="2">PRE: REQUISITE:</td><td>THEORETICAL:</td></tr>
<tr><td>PRACTICAL:</td></tr>
<tr><td colspan="3">GOAL: This module is designed to introduce the trainee with the knowledge of farm tractor</td></tr>
<tr><td colspan="3">GENERAL OBJECTIVE: On completion of this module, the trainee should be able to:

1.0 Understand source of power, classification of tractor
2.0 Understand the basic tractors components (engine systems, power transmission, hydraulic systems, controls and operation).
3.0 Understanding tractor Hitching system of a drawn implements</td></tr>
</table>

PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE						
MODULE: INTRODUCTION TO TRACTOR			**SUBJECT CODE:** CAM 131		**CONTACT HOURS**	
					THEORETICAL: 36 HOURS	
YEAR: 1 **TERM:** 3			**PRE: REQUISITE:**		**PRACTICAL:** 48 HOURS	
GOAL: This module is designed to introduce the trainee with the knowledge of farm tractor						
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
GENERAL OBJECTIVE 1.0: Understand source of power, classification of tractor						
WEEK	**SPECIFIC LEARNING OUTCOME**	**TEACHERS ACTIVITIES**	**RESOURCES**	**SPECIFIC LEARNING OUTCOME**	**TEACHERS ACTIVITIES**	**RESOURCES**
1 -5	1.1 Describe the different sources of farm power available which are classified as: • Human power • Animal power • Mechanical power (Tractors + Power tillers + Oil engines) • Electrical power • Renewable energy (Biogas + Solar energy + Wind energy) 1.2 Define farm tractor 1.3 Discuss the history of farm tractor	Explain the different sources of farm power available which are classified as: • Human power • Animal power • Mechanical power (Tractors + Power tillers + Oil engines) • Electrical power • Renewable energy (Biogas + Solar energy + Wind energy) Explain tractor, its definition Explain the features of a tractor	Marker, White Board, Black board, Chalk, Smart board, Computer, Internet, Projector, Textbooks, Slides Diagrams Charts Video player	Discuss the different sources of farm power	Guide trainees to: Observe the different sources of farm power	Tractor Power tiller

	1.4 Describe the features of a tractor 1.5 Describe classification of farm tractors base on size, power and application • Wheel tractor • Crawler tractor • Walking tractor 1.6 Describe general purpose of row crop and special tractors 1.7 Describe selection of farm tractor depending on: • Land holding • Cropping pattern • Soil condition • Climate condition • Repairing facilities • Running cost • Resale value etc. 1.8 Describe a power tiller 1.9 Describe components of power tiller its operation and power transmission	Explain classification of farm tractors base on size, power and application • Wheel tractor • Crawler tractor • Walking tractor Explain general purpose of row crop and special tractor Explain selection of farm tractor depending on: • Land holding • Cropping pattern • Soil condition • Climate condition • Repairing facilities • Running cost • Resale value etc. Explain a power tiller Explain components of power tiller its operation and power transmission		.		

GENERAL OBJECTIVE 2.0: Understand the basic tractors components (engine systems, power transmission, hydraulic systems, controls and operation).						
5-7	2.1. Describe tractor main components e.g.: • Engine • Clutch	Explain tractor main components e.g.: • Engine • Clutch	Marker Chalk blackboard White Board			Tractor Power tiller

	• Transmission • Differential • Final drive • Rear wheel • Steering mechanism • Hydraulic • Brakes etc. 2.2 Describe the tractor engine system: • Diesel engine principle • Engine components: cylinders, pistons, camshafts, valves, fuel injection system etc. 2.3 Describe the tractor transmission system: • Gear selection and shifting operation • Clutch mechanism and proper engagement • Power take-off(PTO) operation and attaching implements • Transmission types(manual, power shift, hydrostatic) 2.4 Describe tractors tyres and front axle	• Transmission • Differential • Final drive • Rear wheel • Steering mechanism • Hydraulic • Brakes etc. Explain the tractor engine system: • Diesel engine principle • Engine components: cylinders, pistons, camshafts, valves, fuel injection system etc. Explain the tractor transmission system: • Gear selection and shifting operation • Clutch mechanism and proper engagement • Power take-off(PTO) operation and attaching implements • Transmission types Explain tractors tyres and front axle	Smart board Textbooks Slides Diagrams Computer Projector Internet Charts Video player .			Power Take-Off (PTO) Engine model

GENERAL OBJECTIVE 3.0: Understanding tractor Hitching system of a drawn implements						
7-10	3.1 Define a hitching system	Explain hitching system	Marker White Board Smart board			Trailed type

	3.2 Describe hitching system of tractor drawn implements • Trailed type implement • Semi-mounted type implement • Mounted type implement 3.3 Describe the following: • Wheel base • Ground clearance • Track • Turning space • Cage wheel	Explain hitching system of tractor drawn implements: • Trailed type implement • Semi-mounted type implement • Mounted type implement. Explain the following: • Wheel base • Ground clearance • Track • Turning space • Cage wheel	Textbooks Slides Diagrams Computer Projector Internet Charts Video player			implement Semi-mounted type implement Mounted type implement Tractor

	ASSESSMENT CRITERIA			
	Coursework	Course Test 40%	Practical 0%	Other: Examination/Project 60%

<table>
<tr><td colspan="3">PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE</td></tr>
<tr><td>MODULE: GENERAL METAL WORK II</td><td>SUBJECT CODE: CAM 132</td><td>CONTACT HOURS:</td></tr>
<tr><td>YEAR: 1 TERM: 3</td><td rowspan="2">PRE: REQUISITE: CAM 121</td><td>THEORETICAL:</td></tr>
<tr><td></td><td>PRACTICAL:</td></tr>
<tr><td colspan="3">GOAL: This module is designed to introduce to the trainee with knowledge and skills of general metal work</td></tr>
<tr><td colspan="3">GENERAL OBJECTIVE: On completion of this module, the trainee should be able to:

1.0 Understand the basic principles of heat treatment of metal in the workshop.
2.0 Know how to produce simple engineering components by forging.
3.0 Know the basic principles and techniques of gas and metal arc welding.</td></tr>
</table>

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN ENGINEERING CRAFT PRACTICE						
MODULE: GENERAL METAL WORK II		**COURSE CODE:** CAM 132		**CONTACT HOURS:** 60		
				THEORETICAL:		
YEAR: 2 **TERM:** 1		**PRE: REQUISITE:** CME 11		**PRACTICAL:**		
GOAL: This module is designed to introduce to the trainee with knowledge and skills of general metal work.						
Theoretical Content				**Practical Content**		
GENERAL OBJECTIVE 1.0: Understand the basic principles of heat treatment of metal in the workshop..						
WEEK	**SPECIFIC LEARNING OUTCOME**	**TEACHERS ACTIVITIES**	**RESOURCES**	**SPECIFIC LEARNING OBJECTIVES**	**TEACHERS ACTIVITIES**	**RESOURCES**
1-4	1.1 Explain the structural behaviour of plain carbon steel as it is heated from room temperature to about 1000ºC for the purposes of: • Hardening • Tempering • Annealing • Normalising • Case-Hardening. 1.2 Explain hardening metal work. 1.3 Outline safety precautions relating to heat treatment processes apply them in given situations.	Explain briefly the structural behaviour of plain carbon steel as it is heated from room temperature to about 1000ºC for the purposes of: • Hardening • Tempering • Annealing • Normalising • Case-Hardening. Explain hardening metal work. Explain safety precautions relating to heat treatment processes apply them in given situations	Text books Slides Video Player Smart Board White Board Blackboard Marker Chalk Computer Projector Internet	Know the structural behaviour of plain carbon steel as it is heated from room temperature to about 1000ºC Demonstrate hardening metal work. Know safety precautions relating to heat treatment processes and apply them in a given situations	Guide trainees to: Identify the structural behaviour of plain carbon steel as it is heated from room temperature to about 1000ºC Demonstrate hardening metal work. Carryout safety precautions relating to heat treatment processes and apply them in a given situations	Furnace Forge tongs PPE Pliers

GENERAL OBJECTIVE 2.0: Know how to produce simple engineering components by forging.						
5-8	2.1 Describe with outline sketch the main features and working principles of the	Explain with sketch the main features and working principles of the black	Text books Slides Video Player	Identify the main features and working principles of the black smith's forge.	Guide trainees to: Identify the main features and	Anvil Swage block

	black smith's forge. 2.2 Describe functions of common forging tools: • Anvil • Swage block • Leg vice • Forging hammers • Hot and cold sets • Set hammer • Punches and drifts • Hardie • Fullers • Top and bottom swages flatter • Tongs (open mouth, closed mouth, hollow bit, etc.). 2.3Describe appropriate forging tools for forging operations in a given engineering components 2.4 Describe with sketches the following forging operations: • Upsetting • Drawing down • Setting down • Twisting • Forge welding (scarf and splice welds) • Bending • Forming closed ring • Forming an eye.	smith's forge. Explain the functions of common forging tools: • Anvil • Swage block • Leg vice • Forging hammers • Hot and cold sets • Set hammer • Punches and drifts • Hardie • Fullers • Top and bottom swages flatter • Tongs (open mouth, closed mouth etc) Explain how to select appropriate forging tools for forging operations in a given engineering components Explain with sketches the following forging operations as in 2.3	Smart Board White Board Marker Computer Projector Internet Diagrams	Identify the functions of common forging tools Select appropriate forging tools for forging operations given engineering components	working principles of the black smith's forge. Demonstrate forging using common forging tools carryout forging operations in a given engineering components using appropriate forging tools	Leg vice Forging Hammers Hot set Cold set Sets of hammer Punchers Drifts Fillers Top swage Bottom swage Flatter Open tongs Hallow bit

GENERAL OBJECTIVE 3.0 Know the basic principles and techniques of gas and metal arc welding.						
9-12	3.1 Describe basic principles and application of gas and metal arc welding. 3.2 State the safety precautions to be observed and apply them in given welding situations. 3.3 Differentiate between gas welding Arc welding : Gas welding • Block pipes • Nucleus • Spack lighter • Blow pipes Arc welding • Cliams • Cables • Electros • AC/DC welder	Explain basic principles and application of gas and metal arc welding. Explain the safety precautions to be observed and apply them in given welding situations. Identify differences Arc and gas welding	Text books Slides Video Player Smart Board White Board Marker Computer Projector Internet Diagrams	Identify basic principles and application of gas and metal arc welding. Know safety precautions to be observed and apply them in given welding situations. Identify difference tools between Gas and Arc welder	Guide trainees to: Identify basic principles and application of gas and metal arc welding. Observe the safety precautions and apply them in given welding situations. Recognize gas welding Arc welding tools :	Electric Arc welding Machine, Oxy-Acetelene Set, PPE, Hammers, Knife tool, Form tool, Parting-off tool, Boring tool

	ASSESSMENT CRITERIA			
	Coursework	Course Test 30%	Practical 20%	Other: Examination/Project 50%

<table>
<tr><td colspan="3">PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE</td></tr>
<tr><td>MODULE: ALTERNATIVE ENERGY MECHANIZATION</td><td>SUBJECT CODE: CAM 211</td><td>CONTACT HOURS:</td></tr>
<tr><td>YEAR: 2 TERM: 1</td><td rowspan="2">PRE: REQUISITE:</td><td>THEORETICAL:</td></tr>
<tr><td></td><td>PRACTICAL:</td></tr>
<tr><td colspan="3">GOAL: This module is aimed at providing trainee with knowledge and skills in the maintenance and troubleshooting of alternative energy equipment.</td></tr>
<tr><td colspan="3">GENERAL OBJECTIVE: On completion of this module, the trainee should be able to:

1.0 Understand Photovoltaic (PV) systems and perform maintenance

2.0 Know the skills to maintain and troubleshoot inverters and associated electrical components of the PV assembly

3.0 Know the skills to maintain and troubleshoot wind turbine equipment

4.0 Understand Solar Thermal System Maintenance</td></tr>
</table>

PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE						
MODULE: ALTERNATIVE ENERGY MECHANIZATION			**COURSE CODE:** CAM 211		**CONTACT HOURS:**	
					THEORETICAL:	
YEAR: 2 **TERM:** 1			**PRE: REQUISITE:**		**PRACTICAL:**	
GOAL: This module is aimed at providing trainee with knowledge and practical skills in the maintenance and troubleshooting of alternative energy equipment.						
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
GENERAL OBJECTIVE 1.0: Understand Photovoltaic (PV) systems and perform maintenance						
WEEK	**SPECIFIC LEARNING OUTCOME**	**TEACHERS ACTIVITIES**	**RESOURCES**	**SPECIFIC LEARNING OBJECTIVES**	**TEACHERS ACTIVITIES**	**RESOURCES**
1-2	1.1 Define Photovoltaic (PV) systems 1.2 Explain the function of PV modules and arrays. 1.3 Explain the construction of PV modules and arrays. 1.4 Explain types of PV arrays: • Series • Parallel • Combination 1.5 Discuss the components of a PV system: • PV solar panel • Controller • Breakers • DC cables • Inverter, etc. 1.6 Discuss the functions of the components	Explain PV system Explain functions of PV modules and arrays. Explain the construction of PV modules and arrays. Explain types of PV arrays: • Series • Parallel • Combination Explain components of the PV system: • PV solar panel • Controller • Breakers • DC cables • Inverter, etc. Explain functions of the components	Charts White Board Blackboard Chalk Slides Drawings Projector Computer Internet Markers Multimedia	Know components of PV system	Guide trainees to: Identify components of PV system Rectify defects in PV system	Solar PV panel Controller Inverter Cables Non-abrasive Hand tools Cleaning agent Multi meters Solar PV technical manual Electrical tool box

	1.7 Discuss common defects such as: • Micro cracks • Delamination • Shading issues. 1.8 Discuss cleaning techniques 1.9 Discuss basic repair methods to maximize energy output. 1.10 Explain the production of a PV array system	Explain common defects such as: • Micro cracks • Delamination • Shading issues. Explain cleaning techniques Explain basic repair methods to maximize energy output. Explain the production of a PV array system		Identify defects in PV system Know Cleaning operations on the PV array Know basic methods of maintenance Understand a PV system assemble Measure PV Voltage from Inverter `	Perform Cleaning operations on the PV array Demonstrate basic methods of maintenance Construct a PV system assemble. Measure PV Voltage from Inverter	

GENERAL OBJECTIVE 2.0: Know the skills to maintain and troubleshoot inverters and associated electrical components of the PV assembly						
3-4	2.1 Define Inverters 2.2 Explain types of inverters 2.3 Discuss the operational principles of inverters 2.4 Discuss common electrical faults, such as: • Voltage irregularities	Explain Inverters Explain types of inverters Explain the operational principles of inverters Explain common electrical faults, such as: • Voltage irregularities	Charts White Board Blackboard Slides Drawings Projector Computer Internet Markers Chalk Multimedia	Identify an Inverters Identify types of inverters Use diagnostics tool (Multi-meter, oscilloscope thermal camera)	Guide trainees to: Identify an Inverters Identify types of inverters Use diagnostics tool (Multi-meter, oscilloscope thermal camera)	Solar PV panel. Controller. Inverter. Cables. Non-abrasive hand tools, Cleaning agent, Multi meters,

	• Component overheating. 2.5 Discuss diagnostic tools to PV assembly	• Component overheating. Explain diagnostic tools to PV assembly	Schematic and Technical manuals			Solar PV technical manual, Diagnostic tools like Solar meter.

GENERAL OBJECTIVE 3.0: Know the skills to maintain and troubleshoot wind turbine equipment						
5 - 7	3.1 Define wind energy 3.2 Discuss wind Turbine 3.3 Describe types of wind turbine: • Horizontal axis • Vertical axis • Bladeless • Micro wind turbines 3.4 Discuss components of wind turbine: • Foundation • Tower • Rotor • Blade (hub) • Nacelle • Generator	Explain wind energy Explain wind Turbine Explain types of wind turbine: • Horizontal axis • Vertical axis • Bladeless • Micro wind turbines Explain components of wind turbine: • Foundation • Tower • Rotor • Blade (hub) • Nacelle • Generator	Charts White Board blackboard Slides Drawings Projector Computer Internet Markers Chalk Multimedia	Identify wind turbine Identify types of wing turbine Identify components of wind turbine Identify structural issues such as erosion, cracks, and delamination. Visit an existing wind turbine facility	Guide trainees to: Identify wind turbine Identify types of wing turbine Identify components of wind turbine Identify structural issues such as erosion, cracks, and delamination.	Wind turbine components, Wind turbine facility, Tool box, Electrical repair kit, (Avometer, voltmeter, etc.) PPE

	3.5 Discuss the aerodynamic principles of wind turbine blades. 3.6 Discuss structural issues encountered in wind turbine system such as: • Erosion • Cracks • Delamination. 3.7 Explain the integration of electrical components and control systems within wind turbines. 3.8 Explain common faults in control systems such as sensor failures and wiring issues 3.9 Know routine inspections and minor repairs on components in line with national safety standards such as: • Motor • Generator • Blade	Explain the aerodynamic principles of wind turbine blades. Explain structural issues encountered in wind turbine system such as: • Erosion • Cracks • Delamination Explain the integration of electrical components and control systems within wind turbines. Explain common faults in control systems such as sensor failures and wiring issues Explain routine inspections and minor repairs on components in line with national safety standards such as: • Motor • Generator • Blade		Identify minor routine inspections and repairs on turbine system in line with national safety standards. Know common faults in control systems such as sensor failures and wiring issues Explain routine inspections and minor repairs on components in line with national safety standards such as in 3.9	Visit an existing wind turbine facility Perform minor routine inspections and repairs on turbine system in line with national safety standardss Rectify common faults in control systems such as sensor failures and wiring issues Carry out routine inspections and minor repairs on components in line with national safety standards	

GENERAL OBJECTIVE 4.0: Understand Solar Thermal System Maintenance						
	4.1 Define Solar thermal collectors	Explain Solar thermal collectors	Charts White Board Slides	Identify solar thermal collectors	Guide trainees to: recognize solar thermal collectors	Solar thermal Assembly

	4.2 Discuss types of solar thermal collectors 4.3 Discuss fluid system for solar thermal collectors 4.4 Explain operation of solar thermal collectors and associated fluid systems. 4.5 Discuss issues with solar thermal collector system such as: • Scaling • Leaks • Insulation failures. 4.6 Explain maintenance protocols to optimize heat collection and energy efficiency.	Explain types of solar thermal collectors Explain fluid system for solar thermal collectors Explain operation of solar thermal collectors and associated fluid systems. Explain issues with solar thermal collector system such as: • Scaling • Leaks • Insulation failures. Explain maintenance protocols to optimize heat collection and energy efficiency.	Drawings Projector Computer Internet Markers Multimedia	Know fluids used solar thermal collectors Understand operation of solar thermal collectors in fluid distribution systems Identify issues such as scaling, leaks, and insulation failures. Repair common issues in fluid distribution systems. Know documentation of maintenance activities	Identify fluids used solar thermal collectors Perform inspections of solar thermal collectors to identify common issues in fluid distribution systems Identify issues such as scaling, leaks, and insulation failures Repair common issues in fluid distribution systems. Carryout documentation of maintenance activities	Hand Tools Repair kits for fluid system Cleaning kits Insulation repair kits Standardized logbooks
GENERAL OBJECTIVE 5.0: Know the maintenance of Battery Energy Storage System Maintenance						
	5.1 Explain the types of batteries used in energy storage: • Lithium-ion • Lead-acid 5.2 Discuss Battery Management system (BMS) 5.3 Discuss the function of BMS	Explain the types of batteries used in energy storage: • Lithium-ion • Lead-acid Explain Battery Management system (BMS)	Charts White Board Blackboard Slides Drawings Projector Computer Internet Markers Chalk Multimedia	Identify types of batteries in Solar energy storage Discuss Battery Management System	Guide trainees to: Recognize types of batteries in Solar energy storage Identify Battery Management System	Solar Battery Bank Diagnostic tool kit for battery (voltage testers, thermal sensors).

	5.4 Discuss maintenance needs for types of batteries 5.5 Discuss documentation of battery performance e.g.: • Voltages • Current 5.6 Discuss common issues with battery management such as: • Capacity degradation • Thermal runaway • Electrical faults. • 5.7 Describe routine maintenance and safety protocols	Explain the function of BMS Explain maintenance needs for types of batteries Explain documentation of battery performance e.g.: • Voltages • Current Explain common issues with battery management: such as: • Capacity degradation • Thermal runaway • Electrical faults. Explain routine maintenance and safety protocols	Texbooks	Conduct routine inspections of battery modules and BMS. Know maintenance needs for types of batteries Identify performance degradation and document maintenance activities. Identify corrective actions on defective battery systems under supervision .	Conduct routine inspections of battery modules and BMS. Carryout Maintain different types of batteries Carryout performance degradation and document maintenance activities. Perform corrective actions on defective battery systems under supervision	PPE (gloves, eye shield, insulated tools etc.) Electrical/ Electronic tools box
	ASSESSMENT CRITERIA					
	Coursework	Course Test 30%	Practical 40%	Other: Examination/Project 30%		

<table>
<tr><td colspan="3">PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE</td></tr>
<tr><td>MODULE: IMPLEMENTS AND MACHINES I</td><td>SUBJECT CODE: CAM 212</td><td>CONTACT HOURS:</td></tr>
<tr><td>YEAR: 2 TERM: 1</td><td rowspan="2">PRE: REQUISITE:</td><td>THEORETICAL:</td></tr>
<tr><td></td><td>PRACTICAL:</td></tr>
<tr><td colspan="3">GOAL: This module is designed to provide the trainee with the knowledge to identify and perform routine maintenance of different farm implements and machines.</td></tr>
<tr><td colspan="3">GENERAL OBJECTIVE: On completion of this module, the trainee should be able to:

1.0 Know routine maintenance of tillage implements.
2.0 Know routine maintenance of planting equipment.
3.0 Know routine maintenance of fertilizer applicators and manure spreaders
4.0 Know routine maintenance of inter-row cropping machinery
5.0 Know routine maintenance of spraying and dusting equipment</td></tr>
</table>

PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE						
MODULE: IMPLEMENT AND MACHINE 1			**COURSE CODE:** CAM 212		**CREDIT HOURS:** **THEORETICAL:**	
YEAR: 2	**TERM:** 1		**PRE REQUISITE:**		**PRACTICAL:**	
GOAL: This module is designed to provide the trainee with the knowledge and skills to identify and perform routine maintenance						
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
GENERAL OBJECTIVE: 1.0: Know routine maintenance of tillage implements.						
WEEK	**SPECIFIC LEARNING OUTCOME**	**TEACHERS ACTIVITIES**	**RESOURCES**	**SPECIFIC LEARNING OBJECTIVES**	**TEACHERS ACTIVITIES**	**RESOURCES**
1-3	1.1 Define tillage 1.2 Describe primary and secondary tillage operations 1.3 List general tillage objectives. 1.4 List primary tillage implements. 1.5 List secondary tillage implements. 1.6 Discuss the working principle of: • Disc plough • Disc harrow • Ridger • Rotary plough.	Explain tillage. Explain primary and secondary tillage operations Explain the tillage objectives Explain primary tillage implement. Explain secondary tillage implements Explain the working principles of: • Disc plough • Disc harrow • Ridger • Rotary plough.	Marker Chalk White Board Blackboard Textbooks Projector Computer Internet Slides Diagrams Charts	Identify primary and secondary tillage implements	Guide trainees to: Identify primary and secondary tillage implements	Farm Toolbox Disc plough Disc harrow Disc ridger Mould-board Ridger, Disc blade Disc bearing Rotovator

	1.7 Describe the various types of harrow and ploughs arrangement • Single row • Multiple row • V-arrangement (off-set arrangement) • Tandem 1.8 Describe the various parts of harrow and plough e.g.: • Disc-shaft • Flashers • Dash bars • Tool bars • Arrangement 1.9 Explain the removal and installation of worn out or damaged disc or blades on ploughs, harrows, rotovators and ridgers.	Explain the various types of harrows and ploughs arrangement: • Single row • Multiple row • V-arrangement (off-set arrangement) • Tandem Explain the various parts of harrow and plough e.g.: • Disc-shaft • Flashers • Dash bars • Tool bars • Arrangement Explain the removal and installation of worn out or damaged disc or blades on ploughs, harrows, rotovators and ridgers.		Identify the various types of harrow and plough arrangement. Identify the various parts of harrow and plough Know the process of removal and installations of worn out or damaged disc or blades on ploughs, harrows, rotovators and ridgers.	Recognize the various types of harrow and ploughs arrangement Recognize the various types of harrow and plough arrangement. Remove and install worn out or damaged disc or blades on ploughs, harrows, rotovators and ridgers.	

GENERAL OBJECTIVE 2.0: Know routine maintenance of planting equipment.						
4-5	2.1 Describe working principles of planting equipment	Explain the working principles of planting equipment	Marker White Board Textbooks Projector Computer Internet Slides	Identify different types of planting equipment	Guide trainees to; Identify planting equipment	Seed Planters Combine Drill Root crop planter

	2.2 Describe different types of planting equipment e.g.: • Hand drill • Seed drill • Combine drill • Seed planters • Root crop planting equipment	Explain different types of planting equipment e.g.: • Hand drill • Seed drill • Combine drill • Seed planters • Root crop planting equipment	Diagrams Charts			Hand planters Farm Tool Box PPE Seed plate Seed upper Metering unit Delivering unit
	2.3 Describe the operational adjustment, setting and checking of application rate.	Explain the operational setting and checking of application rate		Know operational adjustment, setting and checking of application rate of planters.	Carry out setting adjustment and application rate of planters	
	2.4 Describe the coupling, and decoupling of planting equipment to a tractor	Explain the coupling, and decoupling of planting equipment from tractor		Know coupling and de-coupling of planting equipment to a tractor	Carryout coupling and de-coupling of planting equipment to a tractor	
	2.5 Describe the various parts of planting equipment e.g.: • Seed plate • Seed upper • Metering unit • Delivering unit	Explain the various parts of planting equipment e.g.: • Seed plate • Seed upper • Metering unit • Delivering unit		Identify the various parts of planting equipment as in 2.5	Identify the various parts of planting equipment as in 2.5	
	2.6 Explain the removal and maintenance of worn out parts in 2.5 above 2.7 Explain the removal and replacement of damaged parts in 2.5 above	Explain the removal and maintenance of worn out parts in 2.5 above		Check, repair damaged or replace worn out parts	Check, repair damaged or replace worn out parts	

		Explain the removal and replacement of damaged parts in 2.5 above				

GENERAL OBJECTIVE 3.0: Know routine maintenance of fertilizer applicators and manure spreaders						
6-8	3.1 Explain the principles of fertilizer application and manure spreaders 3.2 Describe different types of fertilizer applicators and manure spreaders 3.3 Describe the maintenance of both fertilizer applicators and manure spreaders 3.4 Describe the calibration of application rate for fertilizer applicator 1.5 Describe the operation of fertilizer applicators and manure spreaders	Explain the principles of fertilizer applicators and manure spreaders Explain different types of fertilizer and manure applicator Explain the maintenance of both fertilizer applicators and manure spreaders Explain the calibrating of application rate for fertilizer applicator Explain the operation with fertilizer applicator and manure spreader Explain the dismantling, assembly, replacement	Marker Chalk White Board Blackboard Projector Computer Internet Slides Diagrams Charts Textbooks	Identify different types fertilizer applicators and manure spreaders Identify maintenance requirement on both fertilizer applicators and manure spreaders Identify calibration rate for fertilizer applicators Know operations of fertilizer applicators and manure spreaders	Guide trainees to: Carryout maintenance on both fertilizer applicators and manure spreaders Calibrate fertilizer applicator Operate fertilizer applicators and manure spreaders Dismantle, repair,	Farm Tool Box Fertilizer applicator Manure spreader

	1.6 Describe the dismantling, assembly, replacement or repairs of damaged or worn out parts.	or repairs of damaged or worn out parts.		Identify damage worn out parts on fertilizer applicators and manure spreaders	assemble damaged of worn out parts	

GENERAL OBJECTIVE 4.0: Know routine maintenance of inter-row cropping machinery						
9-10	4.1 Explain working principles of inter-row machinery 4.2 Describe inter-row machinery, accessories and fittings 4.3 Differentiate between weeders and cultivators 4.4 Describe the mounting and dismounting of inter-row machinery on a tractor. 4.1 Describe the repair or replacement of worn out or damage parts	Explain the working principles of inter-row machinery. Explain inter-row machinery, accessories and fittings. Explain the differences between weeders and cultivators. Explain the mounting, use and dismounting of inter row machinery. Explain the repair of damage parts or replacement of worn out parts	Marker, Chalk Slides Diagrams White Board, Blackboard Projector Computer Internet Charts Textbooks	Identify working principles inter- row machinery on a tractor. Identify worn out or damage parts. Explain the mounting, use and dismounting of inter row machinery	Guide trainees to: Mount and dismount inter-row machinery on a tractor. Perform repair or replace worn out or damage parts.	Farm Tool Box Inter-row Planter Weeders and Cultivators

GENERAL OBJECTIVE 5.0: Know routine maintenance of spraying and dusting equipment						
11-12	5.1 Discuss the working principle of spraying and dusting equipment 5.2 Describe the maintenance of spraying and dusting equipment 5.3 Describe the calibration of application rate for spraying and dusting chemicals 5.4 Describe the operation of spraying and dusting equipment 5.5 Describe the dismantling, assembly, replacement or repair of damaged or worn out parts	Explain the working principle of spraying and dusting Equipment Explain the maintenance of spraying and dusting equipment Explain the calibration for spraying and dusting equipment Explain the operation of spraying and dusting equipment. Explain the dismantling, assembly, repair of damaged or replacement of worn out parts	Marker Slides Diagrams White Board Projector Computer Internet Charts Textbooks	Identify maintenance needs for spraying and dusting equipment Know calibration of spraying and dusting equipment Know spraying and dusting equipment Identify repairs of spraying and dusting equipment	Guide trainees to: Carryout maintenance spraying and dusting equipment Carryout calibration of spraying and dusting equipment Operate spraying and dusting equipment Dismantle, assemble, replace damaged or repair worn out parts	Boom Sprayer Knapsack Sprayer Manure Spreader Duster
	ASSESSMENT CRITERIA					
	Coursework	Course Test 20%	Practical 60%	Other: Examination/Project 20%		

	PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE						
	MODULE: MACHINING OPERATIONS			**COURSE CODE:** CAM 213		**CONTACT HOURS:**	
						THEORETICAL:	
	YEAR: 2	**TERM:** 1		**PRE: REQUISITE:** CAM 112		**PRACTICAL:**	
	GOAL: This module is designed to provide the trainee with the knowledge and skills of machining, metal cutting and shaping operation. .						
	THEORETICAL CONTENT				**PRACTICAL CONTENT**		
	GENERAL OBJECTIVE 1.0: Know the tools and machines use in metal shaping operations.						
WEEK	**SPECIFIC LEARNING OUTCOME**	**TEACHERS ACTIVITIES**		**RESOURCES**	**SPECIFIC LEARNING OBJECTIVES**	**TEACHERS ACTIVITIES**	**RESOURCES**
1-3	1.1 Define metal shaping operations 1.2 List the machines use in metal shaping operations: e.g.: • Lathe • Grinding machine • Power sawing machine • Drilling machine • Milling machine. 1.3 List the tools use in metal shaping operation e.g.: • Files hacksaw • Punches • Hand drills etc.	Explain metal shaping operations Explain the machines use in metal shaping operations e.g.: • Lathe • Grinding machine • Power sawing machine • Drilling machine • Milling machine Explain the tools use in metal shaping operation e.g.: • Files hacksaw • Punches • Hand drills		Marker Slides Diagrams White Board Projector Computer Internet Charts Textbooks	Identify tools and machines for metal shaping operations. Identify tools use in metal shaping operation Use machines to carry out metal shaping and cutting operation. Use hand tools to carry out cutting and shaping of metals.	Guide trainees to: Identify the tools and machines for metal shaping operations. Identify tools use in metal shaping operation Use machines to carry out metal shaping and cutting operation. Use hand tools to carry out cutting and shaping of metals.	Workshop Tool Box Lathe machine Grinding machine Power saw Drilling machine Milling machines General Hand Tools (files hacksaw, punches, hand drills etc.)

	1.4 Understand the operations of tools and machines used in metal shaping. 1.5 Understand the operations of machines for metal shaping operations 1.6 Understand the use of tools and machines for simple machine shaping operation	etc. Explain the operations of tools and machines used in metal shaping. Discuss the operations of machines for metal shaping operations Explain the use of tools and machines for simple machine shaping operation			Carry out shaping on lathe and milling machines Use tools to carry out simple machine shaping operation	Carry out shaping on lathe and milling machines Use tools to carry out simple machine shaping operation	

	GENERAL OBJECTIVE 2.0: Know the principles of metal shaping operations						
4-8	2.1 Understand metal cutting Operation 2.2 Understand the principle of metal shaping and chip formation. 2,3 Understand how to plan for a shaping operation	Explain metal cutting Operation. Explain the principle of metal shaping and chip formation Explain how to plan for a shaping operation		Marker Slides Diagrams White Board Projector Computer Internet Charts Textbooks	Use common hand tools to cut metals Operate metal shaping machine Plan for a shaping operation.	Guide trainees to: Use common hand tools to cut metals Operate metal shaping machine Plan for a shaping operation. Operate the lathe and other	Marking Tools: (Steel rule, Calliper, ‘V’ Block, Scriber, Surface Plate, Surface Gauge, Angle Plate) Files hacksaw Punches Hand drills Chisel

	2.4 Describe the use of machining tools in metal shaping, e.g.: • Lathe • Grinding machine • Power sawing machine • Drilling machine • Milling machine. 2.5 Describe the use of hand machine tools in metal shaping e.g.: • Files hacksaw • Punches • Hand drills etc. 2.6 State the different operating speed, cutting speed and feed for metals on a: • Lathe machine • Drilling machine • Milling machines	Explain the use of machining tools in metal shaping, e.g.: • Lathe • Grinding machine • Power sawing machine • Drilling machine • Milling machine Explain the use of hand machine tools in metal shaping e.g.: • Files hacksaw • Punches • Hand drills etc. Explain the different operating speed, cutting speed and feed for metals on a: • Lathe machine • Drilling machine • Milling			Operate the lathe and other shaping machines for a shaping job . Carry out shaping operation with hand tools and machines	machines for a shaping job i Carry out shaping operation with hand tools and machines	Bench vice Hammer Vernier Calliper Lathe machine Power saw Milling machine Drilling machine Coolant fluid

	2.7 Explain the planning of a machine related operation. 2.8 Describe the operation of : • Metal shaping machine • Lathe saw • Power saw 2.9 Explain the safety precautions in metal shaping operation	machines Describe the planning of machine related operation. Explain the operation of: • Metal shaping machine • Lathe saw • Power saw Explain the safety precautions in metal shaping operation					

	GENERAL OBJECTIVE 3.0 Understand the essential features and working principles of the centre lathe.						
	3.1 Define lathe machine 3.2 Describe the essential features of a centre lathe: • Lathe bed • Headstock • Tailstock • Saddle or carriage, etc.	Explain lathe machine Explain the essential features of a centre lathe: • Lathe bed • Headstock • Tailstock • Saddle or carriage, etc.		Marker Slides Diagrams White Board Projector Computer Internet Charts Textbooks	Identify the essential features of a centre lathe Identify the working principles of the centre lathe	Guide trainees to: Identify the essential features of a centre lathe Identify the working principles of the centre lathe List the functions of	Point tools Grinding machine Lathe machine 3-jaw chuck and lathe machine and accessories Catch plate Face plate Dog lathe

	3.3 Describe the working principles of the centre lathe. 3.4 Describe the functions of centre lathe accessories: • Catch or driving plate • Face plate • Lathe dog or carrier • Lathe centres • Fixed and travelling steadies. 3.5 Describe the differences between the centre lathe, and capstan lathe 3.6 Describe types of cutting fluids use for lathe turning. 3.7 Describe safety precautions to be observed when working on the lathe 3.8 Describe with sketch common tools:	Explain the working principles of the centre lathe Explain the functions of centre lathe accessories: • Catch or driving plate • Face plate • Lathe dog or carrier • Lathe centres • Fixed and travelling steadies. Explain the differences between the centre lathe, and capstan lathe Explain types of cutting fluids use for lathe turning Explain safety precautions to be observed when working on the lathe Explain with sketch common tools:			List the functions of centre lathe accessories Identify types of cutting fluids use for lathe turning. Identify safety precautions to be observed when working on the lathe Draw and label common tools:	centre lathe accessories Identify cutting fluids use for lathe turning Identify safety precautions to be observed when working on the lathe Draw and label common tools: • Butt-brazed tool • Tipped tool	Lathe centers Fixed steadies Travelling steadies Round nose turning tool Fine finishing tool Form tool Parting off tool Boring tool Bar of good length Live/dead centers Site finishing Knife tools

	• Butt-brazed tool • Tipped tool • Bit and holder. 3.9 Describe with sketches tool angles (rake, clearance) stating their values for different metals to be machined. 3.10 Differentiate between various tool shapes and state their uses e.g.: • Round nose rougher • Fine finishing • Side finishing • Knife tool • Form tool • Parting off tool • Boring tool, etc. 3.11 Describe with sketches the effects of wrong setting cutting tools: e.g.:	• Butt-brazed tool • Tipped tool • Bit and holder. Explain with sketches tool angles (rake, clearance) stating their values for different metals to be machined. Explain various tool shapes and state their uses e.g.: • Round nose rougher • Fine finishing • Side finishing • Knife tool • Form tool • Parting off tool • Boring tool, etc. Explain with sketches the effects of wrong setting cutting tools: e.g.: • Vibration and chatter			• Butt-brazed tool • Tipped tool • Bit and holder. Draw and label tool angles (rake, clearance) Identify tool shapes and state their uses Identify with sketches the effects of wrong setting cutting tools	• Bit and holder. Draw and label tool angles (rake, clearance) Identify tool shapes and state their uses Identify with sketches the effects of wrong setting cutting tools	

	• Vibration and chatter • Tool rubbing against or digging into the job. 3.12 Describe the cutting speed and feed with respect to lathe operation. 3.13Describe the cutting speed and feed for given turning operation, the rate of metal removal and time required for carrying out specified turning operations	• Tool rubbing against or digging into the job. Explain the cutting speed and feed with respect to lathe operation. Explain the cutting speed and feed for given turning operation, the rate of metal removal and time required for carrying out specified turning operations			Identify the cutting speed and feed with respect to lathe operation. Identify the cutting speed and feed for given a turning operation, the rate of metal removal and time required for carrying out specified turning operations	Identify the cutting speed and feed with respect to lathe operation. Identify the cutting speed and feed for given turning operation, the rate of metal removal and time required for carrying out specified turning operations	

	GENERAL OBJECTIVE 4.0: Understand the essential features and working principles of the Drill						
	4.1 Define drilling machine 4.2 Describe the various types of drilling machines. 4.3 Describe, with sketches, the main features of a bench or pillar drilling machine.	Explain drilling machine Discuss various types of drilling machines Explain with sketches, the main features of a bench or pillar drilling machine.		Marker Slides Diagrams White Board Projector Computer Internet Charts Textbooks	Identify different types of drilling machines Identify the main features of bench or pillar drilling machine	Guide trainees to: Identify different types of drilling machines Identify the main features of bench or pillar drilling machine Draw the main features of bench	Bench drill Pillar drill Drill bits Twist drill Flat drill Counter sink drill Counterbore drill

	4.4 Describe drill bit 4.5 Describe with sketches each of the following types of drill bits: • Twist drill (taper shank, parallel shank) • Jobbers drill • Flat drill • Countersink drill • Counter bore drill • Combination centre drill.	Explain drill bit Explain with sketches each of the following types of drill bits: • Twist drill (taper shank, parallel shank) • Jobbers drill • Flat drill • Countersink drill • Counter bore drill • Combinatio n centre drill. Explain the effects of following faults in			Draw the main features of bench or pillar drilling machine …… Identify: • Twist drill (taper shank, parallel shank) • Jobbers drill • Flat drill • Countersink drill • Counter bore drill • Combination centre drill Draw and label: • Twist drill (taper shank, parallel shank) • Jobbers drill • Flat drill • Countersink drill • Counter bore drill • Combination centre drill.	or pillar drilling machine Identify: • Twist drill (taper shank, parallel shank) • Jobbers drill • Flat drill • Countersink drill • Counter bore drill • Combination centre drill. Draw and label: • Twist drill (taper shank, parallel shank) • Jobbers drill • Flat drill • Countersink drill • Counter bore drill • Combination centre drill. Identify the effects of	Center drill Taps Tap wrench Die and die stock Rivets Surface table Surface plate Marking Solution Center/dot punches Scribing block PPE Reaming tool

	4.6 Describe the effects of the following faults in a ground twist drill bit: • Point angle too acute; • Point angle too obtuse; • Cutting edges at unequal angles • Insufficient lip clearance • Excessive lip clearance. 4.7 Explain spindle revolution or cutting speed for a specified size of drill using the formulae:- N = 1000S/πd S = πdN/1000 Where S = cutting speed (m/min) N = revolutions/minute D = diameter of drill (mm) π = 3.142 4.8 Explain the causes of drilling faults such as:- • Drill breaking;	a ground twist drill bit: • Point angle too acute; • Point angle too obtuse; • Cutting edges at unequal angles • Insufficient lip clearance • Excessive lip clearance. Explain spindle revolution or cutting speed for a specified size of drill using the formulae: N = 1000S/πd S = πdN/1000 Where S = cutting speed (m/min) N = revolutions/minute D = diameter of drill (mm) π = 3.142 Explain the causes of drilling faults such as:-			Identify the effects of following faults in a: • Ground twist drill • Point angle too acute • Point angle too obtuse etc. Calculate spindle revolution or cutting speed for a specified size of drill.	following faults in a: • Ground twist drill • Point angle too acute • Point angle too obtuse etc. Calculate spindle revolution or cutting speed for a specified size of drill.	

	• Drill coloured blue; • Walls of drilled hole left rough; • Chipped cutting lips. 4.9 Understand safety precautions to be observed when using a drilling machine. 4.10 Explain the purpose of reaming 4.11 Describe different types of hand and machine reamers.	• Drill breaking; • Drill coloured blue; • Walls of drilled hole left rough; • Chipped cutting lips. Explain safety precautions to be observed when using a drilling machine. Explain the purpose of reaming Explain different types of hand and machine reamers.					

	GENERAL OBJECTIVE 5.0**:** Know the care and maintenance of machine tools and machines.						
9-12	1.1 Explain the principle of maintenance and repairs of : • Hand tools • Machining tools • Shaping machines	Explain the principle of maintenance and repairs of: • Hand tools • Machining tools • Shaping machines		Marker Slides Diagrams White Board Projector Computer Internet Charts Textbooks	Carry out repairs and maintenance of: • Hand tools • Machining tools • Shaping machines	Guide trainees to: Carry out repair and maintenance of: • Hand tools • Machining tools • Shaping machines	Workshop Tools box Trolley jack Oil and Lubricants

	1.2 Describe the care and maintenance of machine tools 1.3 Describe the care and maintenance of shaping machine	Explain the maintenance of machine tools. Explain the maintenance of lathe machine and other machines.			Carry out repairs and maintenance of lathe machine and other machines Carry out maintenance of lathe machine and other machines	Carry out repairs and maintenance of lathe machine and other machines Carry out maintenance of lathe machine and other machines	
	ASSESSMENT CRITERIA						
	Coursework	Course Test 20%		Practical 60%	Other: Examination/Project 20%		

<table>
<tr><td colspan="3">PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE</td></tr>
<tr><td>MODULE: TRACTOR AND ITS COMPONENTS</td><td>SUBJECT CODE: CAM 221</td><td>CONTACT HOURS:</td></tr>
<tr><td>YEAR: 2 TERM: 2</td><td rowspan="2">PRE: REQUISITE: CAM 131</td><td>THEORETICAL:</td></tr>
<tr><td></td><td>PRACTICAL:</td></tr>
<tr><td colspan="3">GOAL: This module is aimed at providing trainee with knowledge and skills of tractor layout, components and subsystems of the tractor</td></tr>
<tr><td colspan="3">GENERAL OBJECTIVE: On completion of this module, the trainee should be able to:

1.0 Understand Tractor Layout

2.0 Understand Tractor Fundamental Components and Subsystems

3.0 Understand Cab, Tractor Controls. Instrumentation, Operator Interface Layout and safety requirement

4.0 Know Tractor Starting and Stopping Procedures

5.0 Know implement and cab mounting correctly to the tractor</td></tr>
</table>

PROGRAMME: NTC AND ANTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE						
MODULE TRACTOR AND ITS COMPONENTS			**COURSE CODE:** CAM 221		**CONTACT HOURS:**	
					THEORETICAL:	
YEAR: 2 **TERM:** 2			**PRE: REQUISITE: CAM 131**		**PRACTICAL:**	
GOAL: This module is aimed at providing trainee with knowledge and skills to understand tractor layout and fundamental components and subsystems of the tractor						
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
GENERAL OBJECTIVE 1.0: Understand Tractor Layout						
WEEK	**SPECIFIC LEARNING OUTCOME**	**TEACHERS ACTIVITIES**	**RESOURCES**	**SPECIFIC LEARNING OBJECTIVES**	**TEACHERS ACTIVITIES**	**RESOURCES**
1-2	1.1 Define tractor layout and its key elements 1.2 Discuss impact of layout on tractor performance. 1.3 Recognize the importance of a well-designed layout in overall machinery functionality 1.4 Trace the evolution of tractor design and layout over time. 1.5 Explain key milestones that have influenced modern tractor	Explain tractor layout and its key elements Explain impact of layout on tractor performance. Explain the importance of a well-designed layout in overall machinery functionality Explain the evolution of tractor design and layout over time. Explain key milestones that have influenced modern tractor	Charts White Board Slides Drawings Projector Markers Multimedia Computer Projector Digital schematics System flowcharts	Identify tractor layout and its key elements. Identify the interrelationship between various subsystems within a tractor. Compare legacy designs with current layout trends. Draw and label a diagram of a tractor with component names.	Guide trainees to: Identify tractor layout and its key elements. Identify the interrelationship between various subsystems within a tractor. Compare legacy designs with current layout trends. Draw and label a diagram of a tractor with component names.	Tractor

	configurations. 1.6 Describe the components of a tractor.	configurations Explain the components of a tractor.		List component of a tractor.	List component of a tractor.	

GENERAL OBJECTIVE 2.0: Understand Tractor Fundamental Components and Subsystems						
3-5	2.1 Understand major tractor subsystems and their spatial arrangement: • Engine • Transmission • Hydraulics, etc. 2.2 Understand how subsystem integration influences overall layout efficiency. 2.3 Describe the design and placement of the engine and transmission within a tractor. 2.4 Understand the impact of engine and	Explain major tractor subsystems and their spatial arrangement: • Engine • Transmission • Hydraulics, etc. Explain how subsystem integration influences overall layout efficiency. Explain the design and placement of the engine and transmission within a tractor. Explain the impact of engine and transmission layout on	Charts White Board Slides Drawings Projector Markers Multimedia Computer Projector Digital schematics System flowcharts	List the function of each primary subsystem. Illustrate how these subsystems are arranged in standard tractor layouts. Identify the typical engine and transmission configurations.	Guide trainees to: list the function of each primary subsystem. Illustrate how these subsystems are arranged in standard tractor layouts. Identify the typical engine and transmission configurations.	Tractor engine Transmission Hydraulics Batteries Alternators Control units

	transmission layout on power delivery and balance 2.5 Understand the layout of hydraulic circuits and components in a tractor. 2.6 Discuss how hydraulic design supports various functions like lifting, steering, and attachments. 2.7 Know the design and distribution of electrical components within a tractor. 2.8 Discuss the importance of cable management and component accessibility 2.9 Examine the design considerations for undercarriage and suspension systems.	power delivery and balance Explain the layout of hydraulic circuits and components in a tractor. Explain how hydraulic design supports various functions like lifting, steering, and attachments. Explain the design and distribution of electrical components within a tractor. Explain the importance of cable management and component accessibility Explain the design considerations for undercarriage and suspension systems		Evaluate design choices that affect powertrain efficiency and maintenance access. Identify hydraulic components and their positions within the tractor layout. Identify the routing and integration of hydraulic lines and reservoirs. Identify major electrical components and their locations. Outline methods to optimize electrical routing for safety and performance.	Evaluate design choices that affect powertrain efficiency and maintenance access. Identify hydraulic components and their positions within the tractor layout. Identify the routing and integration of hydraulic lines and reservoirs. Identify major electrical components and their locations Outline methods to optimize electrical routing for safety and performance. Identify the layout of tracks, wheels, and suspension components.	

				Identify the layout of tracks, wheels, and suspension components. Assess the impact of design choices on vehicle stability and wear.	Assess the impact of design choices on vehicle stability and wear.	

GENERAL OBJECTIVE 3.0: Understand Cab, Tractor Controls, Instrumentation, Operator Interface Layout and safety requirement						
6 - 8	3.1 Understand how the undercarriage layout affects traction, stability, and maintenance. 3.2 Understand the function of tractor controls and instruments 3.3 Discuss the role of layout in enhancing operator comfort and efficiency. 3.4 Discuss safety hazards associated with tractor layout configurations.	Explain how the undercarriage layout affects traction, stability, and maintenance. Explain the function of tractor controls and instruments Explain the role of layout in enhancing operator comfort and efficiency. Explain safety hazards associated with tractor layout configurations.	Charts White Board Slides Drawings Projector Markers Multimedia Computer Projector Digital schematics System flowcharts	Detect standard cab configurations and control placements. Identify and describe the purpose of each control Operate controls in a simulated environment. Interpret dashboard instruments Identify safety features and mandatory layout requirements.	Guide trainees to: Detect standard cab configurations and control placements. Identify and describe the purpose of each control Operate controls in a simulated environment. Interpret dashboard instruments Identify safety features and	Tractor Steering Brakes Throttle

	3.5 Know regulatory standards and how they influence layout design.	Explain regulatory standards and how they influence layout design.		Develop strategies to modify layouts to comply with safety and regulatory standards.	mandatory layout requirements. Develop strategies to modify layouts to comply with safety and regulatory standards.	

GENERAL OBJECTIVE 4.0: Know Tractor Starting and Stopping Procedures						
9 - 10	4.1 Describe proper starting and stopping procedures of a tractor. 4.2 Understand steps for the safe operation of a tractor during start-up and shutdown. 4.3 Discuss Troubleshoot starting issues. 4.4 Know steps for the safe operation of a tractor in a field environment. 4.5 Discuss basic tractor maneuvers: • Forward • Reverse	Explain proper starting and stopping procedures of a tractor. Explain steps for the safe operation of a tractor during start-up and shutdown. Explain Troubleshoot starting issues. Explain steps for the safe operation of a tractor in a field environment. Explain basic tractor maneuvers: • Forward • Reverse • Turning	Charts White Board Slides Drawings Projector Markers Multimedia Computer Projector Digital schematics System flowcharts	Identify the steps for starting and stopping a tractor. Demonstrate safe start-up and shutdown procedures. Diagnose and resolve common starting problems. Practice starting and stopping a tractor. Demonstrate safe operation in a field setting. Perform basic maneuvers with precision.	Guide trainees to: Identify the steps for starting and stopping a tractor. Demonstrate safe start-up and shutdown procedures. Diagnose and resolve common starting problems. Practice starting and stopping a tractor. Demonstrate safe operation in a field setting.	Tractor

	• Turning 4.6 Discuss field operation challenges	Explain field operation challenges		Identify and avoid field hazards.	Perform basic maneuvers with precision. Identify and avoid field hazards.	

GENERAL OBJECTIVE 5.0**:** Know implement and cab mounting correctly to the tractor						
11 - 12	5.1 Explain how to mount implement correctly to the tractor for field operation 5.2 Explain the following types of cabs: • Gurgle cab • Canopy rain protector • Sun protector etc. 5.3 Know the procedure of removal and mounting of cabs on tractor.	Explain how to mount implement correctly to the tractor for field operation Explain the following types of cabs: • Gurgle cab • Canopy rain protector • Sun protector etc. Explain the procedure of removal and mounting of cabs on tractor.	Charts White Board Slides Drawings Projector Markers Multimedia Computer Projector Digital schematics System flowcharts	Attach agricultural machinery units to tractor Identify the following types of cabs: • Gurgle cab • Canopy rain protector • Sun protector etc. Remove cabs on tractor Mount cabs on tractor	Guide trainees to: Attach agricultural machinery units to tractor Identify the following types of cabs: • Gurgle cab • Canopy rain protector • Sun protector etc. Remove cabs on tractor Mount cabs on tractor	A Functional Tractor Implements (Plough, Harrow, Ridger Trailer) Working Hydraulic System
	ASSESSMENT CRITERIA					
	Coursework	Course Test 20%	Practical 60%	Other: Examination/Project 20%		

<table>
<tr><td colspan="3">PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE</td></tr>
<tr><td>MODULE: IMPLEMENTS AND MACHINES II</td><td>SUBJECT CODE: CAM 222</td><td>CONTACT HOURS:</td></tr>
<tr><td>YEAR: 2 TERM: 2</td><td rowspan="2">PRE: REQUISITE: CAM 212</td><td>THEORETICAL:</td></tr>
<tr><td></td><td>PRACTICAL:</td></tr>
<tr><td colspan="3">GOAL: This module is designed to provide the trainee with the knowledge and skills to perform routine maintenance on different farm implements and machines.</td></tr>
<tr><td colspan="3">GENERAL OBJECTIVE: On completion of this module, the trainee should be able to:

1.0 Know routine maintenance of crop harvesting equipment
2.0 Know routine maintenance of forage harvesting equipment.
3.0 Know routine maintenance of mowers
4.0 Know routine maintenance of balers
5.0 Know routine maintenance of dairy equipment</td></tr>
</table>

PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE						
MODULE: IMPLEMENT AND MACHINE II		**COURSE CODE:** CAM 222		**CREDIT HOURS:**		
				THEORETICAL:		
YEAR: 2 **TERM:** 2		**PRE-REQUISITE: 212**		**PRACTICAL:**		
GOAL: This module is designed to provide the trainee with the knowledge and skills to perform routine maintenance on different farm implements and machines.						
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
GENERAL OBJECTIVE 1.0: Know routine maintenance of crop harvesting equipment						
WEEK	**SPECIFIC LEARNING OUTCOME**	**TEACHERS ACTIVITIES**	**RESOURCES**	**SPECIFIC LEARNING OBJECTIVES**	**TEACHERS ACTIVITIES**	**RESOURCES**
1-3	1.1 Define crop harvesting equipment 1.2 Describe types of harvesting equipment: • Fruit harvester • Combine harvester • Root crop harvester, etc. 1.3 Describe the working principle of the main component of a : • Combine harvester • Potato digger • Cotton picker • Groundnut lifter • Other root crop harvesters. 1.4 Describe the operation of crop harvesting equipment:	Explain crop harvesting equipment. Explain types of harvesting equipment: • Fruit harvester • Combine harvester • Root crop harvester, etc. Explain the working principles of the main component of a : • Combine harvester • Potato digger • Cotton picker • Groundnut lifter • Other root crop harvesters. Explain the operation of crop harvesting	Marker White Board Textbooks Projector Computer Internet Slides Diagrams Charts	Identify types of crop harvesting equipment Operate harvesting equipment Repair or replace worn out or damage parts. Carry out workshop and field adjustment on crop harvesting equipment	Guide trainees to: Identify types of crop harvesting equipment Carry out operation of crop harvesting equipment Repair or replace worn out or damage parts. Carryout workshop and field adjustment on crop harvesting equipment	Farm Toolbox Combine harvester Potato digger Cotton picker Groundnut lifter Other root crop harvesters.

	• Combine harvester • Potato digger • Cotton picker • Groundnut lifter • Other root crop harvesters. 1.5 Describe the maintenance of crop harvesting equipment	equipment: • Combine harvester • Potato digger • Cotton picker • Groundnut lifter • Other root crop harvesters. Explain the repair of damage parts or replacement of worn out parts.				

GENERAL OBJECTIVE 2.0: Know routine maintenance of forage harvesting equipment						
4 - 6	2.1 Define forage harvesting equipment 2.2 Explain operational principles of forage harvesting equipment 2.3 Describe types of forage harvesting equipment: • Tractor pulled • Cut and throw • Flail type • Self-propelled (combine harvester) 2.4 Describe component of forage harvesting	Explain forage harvesting equipment Discuss operational principle of forage harvesting equipment Explain types of forage harvesting equipment: • Tractor pulled • Cut and throw • Flail type • Self-propelled (combine harvester) Explain components of forage harvesting equipment :	Marker White Board Textbooks Projector Computer Internet Slides Diagrams Charts	Identify types of forage harvesting equipment Identify components of forage harvesting equipment Carry out operation of harvesting equipment Repair and adjust: • Knife assembly	Guide trainees to: Identify types of forage harvesting equipment Identify components of forage harvesting equipment Carry out operation of forage harvesting equipment Repair and adjust: • Knife assembly • Conveyor	Cut and throw harvester Flail type harvester Combine harvester

	equipment: • Knife assembly • Conveyor • Chutes • Shear plate • Reflectors • Gear box 2.5 Describe the repair or replacement of worn out or damage parts	• Knife assembly • Conveyor • Chutes • Shear plate • Reflectors • Gear box Explain the repair of damage parts or replacement of worn out parts.		• Conveyor • Chutes • Shear plate • Reflectors • Gear box Repair or replace worn out or damage parts. Carry out workshop and field adjustment on forage harvesting equipment	• Chutes • Shear plate • Reflector • Gear box Repair or replace worn out or damage parts. Carry out workshop and field adjustment on forage harvesting equipment	

GENERAL OBJECTIVE 3.0: Know routine maintenance of mowers						
7 -9	3.1 Describe different types of mowers e.g.: • Cutter bar • Disc. 3.2 Discuss the working principle of mower e.g.: • Reciprocating (cutter bar) • Rotary (flair and disc). 3.3 Describe the parts of: • Gearbox • Cutter bar	Explain the different types of mowers e.g.: • Cutter bar • Disc. Explain the working principles of mowers e.g.: • Reciprocating (cutter bar) • Rotary (flair and disc). Explain the parts of: • Gearbox	Marker White Board Textbooks Projector Computer Internet Slides Diagrams Charts	Identify the parts of: • Gearbox • Cutter bar • Knife Sharpen knife section, flail disc Remove and replace damage or worn parts	Guide trainees to: Identify the parts of: • Gearbox • Cutter bar • Knife Sharpen knife section, flail disc Remove and replace damage or worn parts	Cutter bar Mower Disc blade mower Reciprocating mower

	• Knife 3.4 Describe the routine maintenance and adjustment of mowers	• Cutter bar • Knife Explain the routine maintenance and adjustment of mowers		Carry out routine maintenance and adjustment of mowers Draw a line diagram to show the various parts of the mower Carry out workshop and field adjustment on mower	Carry out routine maintenance and adjustment of mowers Draw a line diagram to show the parts of the mower Carry out workshop and field adjustment on mower	

GENERAL OBJECTIVE 4.0: Know routine maintenance of balers						
10-12	4.1 Define balers 4.2 Describe different types of balers e.g.: • Vertical • Horizontal • Cutter bar • Disc. 4.3 Describe types of bales: • Square • Round • Compressed 4.4 Discuss the working principle of balers	Explain balers Explain the different types of balers e.g.: • Vertical • Horizontal • Cutter bar • Disc. Explain types of bales: • Square • Round • Compressed Explain the working principles of balers.	Marker White Board Textbooks Projector Computer Internet Slides Diagrams Charts	Identify the following parts: • Pick up mechanism • Knife and shear plates • Tying mechanism Remove and replace damage or worn parts Carry out routine maintenance and adjustment of balers	Guide trainees to: Identify the following parts: • Pick up mechanism • Knife and shear plates • Tying mechanism Remove and replace damage or worn parts Carry out routine maintenance and adjustment of balers	Cutter bar mower Disc blade mower Reciprocating mower

	4.5 Describe the parts of baler: • Pick up mechanism • Knife and shear plates • Tying mechanism 4.6 Describe the routine maintenance and adjustment of balers 4.7 Explain the repair and adjust of: • Pick up mechanism • Packer assembly • Ram assembly • Knife and shear plates • Tying mechanism	Describe the parts of baler: • Pick up mechanism • Knife and shear plates • Tying mechanism Explain the routine maintenance and adjustment of balers Explain the repair and adjust of: • Pick up mechanism • Packer assembly • Ram assembly • Knife and shear plates • Tying mechanism				

GENERAL OBJECTIVE 5.0: Know routine maintenance of dairy equipment						
13 - 15	5.1 Define Dairy equipment 5.2 Discuss operational principles of diary machine 5.3 Describe types of dairy equipment: • Milking machines	Explain dairy equipment Explain Operational principle of dairy machine Explain types of dairy equipment: • Milking machines • Cream separator	Marker White Board Textbooks Projector Computer Internet Slides Diagrams Charts	Identify types of dairy equipment Carry out operation of dairy equipment	Guide trainees to: Identify types of dairy equipment Carry out operation of dairy equipment	Farm Tool Box Milking machines Cream separator Cooling machine

	• Cream separator • Cooling machine • Storage machine • Pasteurizer • Parlor feeding system 5.4 Describe the operation of dairy machine: • Milking machines • Cream separator • Cooling machine • Storage machine • Pasteurizer • Parlor feeding system 5.5 Discuss the repair and replacement of worn out or damage parts	• Cooling machine • Storage machine • Pasteurizer • Parlor feeding system Explain the operation of dairy machine: • Milking machines • Cream separator • Cooling machine • Storage machine • Pasteurizer • Parlor feeding system Explain the repair of damage parts or replacement of worn-out parts.		Carry out repair or replacement of worn out or damage parts.	Carry out repair or replacement of worn out or damage parts.	Storage machine Pasteurizer Parlor feeding system
	ASSESSMENT CRITERIA					
	Coursework	Course Test 20%	Practical 60%	Other: Examination/Project 20%		

GENERAL OBJECTIVE 2.0: Know routine maintenance of forage harvesting equipment						
4 - 6	2.1 Define forage harvesting equipment 2.2 Explain operational	Explain forage harvesting equipment	Marker White Board Textbooks Projector			Cut and throw harvester Flail type

	principles of forage harvesting equipment 2.3 Describe types of forage harvesting equipment: • Tractor pulled • Cut and throw • Flail type • Self-propelled (combine harvester) 2.4 Describe component of forage harvesting equipment: • Knife assembly • Conveyor • Chutes • Shear plate • Reflectors • Gear box 2.5 Describe the repair or replacement of worn out or damage parts	Discuss operational principle of forage harvesting equipment Explain types of forage harvesting equipment: • Tractor pulled • Cut and throw • Flail type • Self-propelled (combine harvester) Explain components of forage harvesting equipment : • Knife assembly • Conveyor • Chutes • Shear plate • Reflectors • Gear box Explain the repair of damage parts or replacement of worn out parts.	Computer Internet Slides Diagrams Charts	Identify types of forage harvesting equipment Identify components of forage harvesting equipment Repair and adjust: • Knife assembly • Conveyor • Chutes • Shear plate • Reflectors • Gear box	Guide trainees to: know types of forage harvesting equipment Recognize components of forage harvesting equipment Carryout repair and adjust of : • Knife assembly • Conveyor • Chutes • Shear plate • Reflector • Gear box Repair or replace	harvester Combine harvester

				Repair or replace worn out or damage parts. Carry out workshop and field adjustment on forage harvesting equipment	worn out or damage parts. Carry out workshop and field adjustment on forage harvesting equipment	
GENERAL OBJECTIVE 3.0: Know routine maintenance of mowers						
7 -9	3.1 Describe different types of mowers e.g.: • Cutter bar • Disc. 3.2 Discuss the working principle of mower e.g.: • Reciprocating (cutter bar) • Rotary (flair and disc). 3.3 Describe the parts of: • Gearbox • Cutter bar • Knife 3.4 Describe the routine maintenance and adjustment of mowers	Explain the different types of mowers e.g.: • Cutter bar • Disc. Explain the working principles of mowers e.g.: • Reciprocating (cutter bar) • Rotary (flair and disc). Explain the parts of: • Gearbox • Cutter bar • Knife Explain the routine maintenance and adjustment of mowers	Marker White Board Textbooks Projector Computer Internet Slides Diagrams Charts	Know different types of mowers Identify components of a typical mower Identify the parts of: • Gearbox • Cutter bar • Knife Know how to sharpen knife section, flail disc Remove and replace damage or worn parts	Guide trainees to: Identify different types of mowers Recognize components of a typical mower Recognize the parts of: • Gearbox • Cutter bar • Knife Sharpen knife section, flail disc Remove and replace damage or worn parts Conduct routine maintenance and	Cutter bar Mower Disc blade mower Reciprocating mower

				Carry out routine maintenance and adjustment of mowers Draw a line diagram to show the various parts of the mower Carry out workshop and field adjustment on mower	adjustment of mowers Draw a line diagram to show the parts of the mower Conduct workshop and field adjustment on mower	
GENERAL OBJECTIVE 4.0: Know routine maintenance of balers						
10-12	4.1 Define balers 4.2 Describe different types of balers e.g.: • Vertical • Horizontal • Cutter bar • Disc. 4.3 Describe types of bales: • Square • Round • Compressed 4.4 Discuss the working principle of balers 4.5 Describe the parts of baler:	Explain balers Explain the different types of balers e.g.: • Vertical • Horizontal • Cutter bar • Disc. Explain types of bales: • Square • Round • Compressed Explain the working principles of balers. Describe the parts of baler:	Marker White Board Textbooks Projector Computer Internet Slides Diagrams Charts	Identify different types of balers	Guide trainees to: Recognize differen types of balers Identify the following parts: • Pick up mechanism	Cutter bar mower Disc blade mower Reciprocating mower

	• Pick up mechanism • Knife and shear plates • Tying mechanism 4.6 Describe the routine maintenance and adjustment of balers 4.7 Understand the repair and adjust of: • Pick up mechanism • Packer assembly • Ram assembly • Knife and shear plates • Tying mechanism	• Pick up mechanism • Knife and shear plates • Tying mechanism Explain the routine maintenance and adjustment of balers Explain the repair and adjust of: • Pick up mechanism • Packer assembly • Ram assembly • Knife and shear plates • Tying mechanism		Identify the following parts: • Pick up mechanism • Knife and shear plates • Tying mechanism Remove and replace damage or worn parts Carry out routine maintenance and adjustment of balers Carry out repair and adjust of: • Pick up mechanism • Packer assembly • Ram assembly • Knife and shear plates Tying mechanism	• Knife and shear plates • Tying mechanism Carryout replacement of damage or worn parts of balers Conduct routine maintenance and adjustment of balers Conduct repairs and adjustment of: • Pick up mechanism • Packer assembly • Ram assembly • Knife and shear plates Tying mechanism	

GENERAL OBJECTIVE 5.0: Know routine maintenance of dairy equipment						
13 - 15	5.1 Define Dairy equipment 5.2 Discuss operational principles of diary machine 5.3 Describe types of dairy equipment: • Milking machines • Cream separator • Cooling machine • Storage machine • Pasteurizer • Parlor feeding system 5.4 Describe the operation of dairy machine: • Milking machines • Cream separator • Cooling machine • Storage machine • Pasteurizer • Parlor feeding system	Explain dairy equipment Explain Operational principle of dairy machine Explain types of dairy equipment: • Milking machines • Cream separator • Cooling machine • Storage machine • Pasteurizer • Parlor feeding system Explain the operation of dairy machine: • Milking machines • Cream separator • Cooling machine • Storage machine • Pasteurizer • Parlor feeding system Explain the repair of damage parts or replacement of worn-out parts.	Marker White Board Textbooks Projector Computer Internet Slides Diagrams Charts	List types of dairy equipment Carry out operation of dairy equipment	Guide trainees to: Identify types of dairy equipment Operate dairy equipment	Farm Tool Box Milking machines Cream separator Cooling machine Storage machine Pasteurizer Parlor feeding system

	5.5 Discuss the repair and replacement of worn out or damage parts			Carry out repair or replacement of worn out or damage parts.	Repair or replace worn out or damage parts.	
	ASSESSMENT CRITERIA					
	Coursework	Course Test 20%	Practical 40%	Other: Examination/Project 40%		

<table>
<tr><td colspan="3">PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE</td></tr>
<tr><td>MODULE: TRACTOR AND ITS COMPONENTS II</td><td>SUBJECT CODE: CAM 231</td><td>CONTACT HOURS:</td></tr>
<tr><td>YEAR: 2 TERM: 3</td><td rowspan="2">PRE: REQUISITE: CAM 221</td><td>THEORETICAL:</td></tr>
<tr><td></td><td>PRACTICAL:</td></tr>
<tr><td colspan="3">GOAL: This module is designed to provide the trainees with the knowledge of tractor and its components</td></tr>
<tr><td colspan="3">GENERAL OBJECTIVE: On completion of this module, the trainee should be able to:

1.0 Understand components of a tractor

2.0 Understand the function of tractor engine.

3.0 Understanding the powertrain of a tractor

4.0 Understand the tractor steering and suspensions system

5.0 Understand the Tractor Hydraulic system (Pump, Cylinders, control valves)

6.0 Understand braking system of a tractor</td></tr>
</table>

PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE						
MODULE: TRACTOR AND ITS COMPONENT II			**COURSE CODE:** CAM 231			**Contact HOURS:** 180
						THEORETICAL:
YEAR: 2 **TERM:** 3			**PRE: REQUISITE:** CAM 221			**PRACTICAL:**
GOAL: This module is designed to provide the trainees with the knowledge of tractor and its components						
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
GENERAL OBJECTIVE 1.0: Understand components of a tractor						
WEEK	**SPECIFIC LEARNING OUTCOME**	**TEACHERS ACTIVITIES**	**RESOURCES**	**SPECIFIC LEARNING OBJECTIVES**	**TEACHERS ACTIVITIES**	**RESOURCES**
1-2	1.1 Know the components of a tractor 1.2 Describe tractor main components: • Engine • Clutch • Gearbox • Differential • PTO • Steering • Brake • Hydraulic • Rear linkages • Tyres 1.3 Describe functions of tractor components • Engine(Cylinder block, pistons, crankshaft) • Powertrain (Clutch, gearbox, differential)	Explain the components of a tractor Explain tractor main components: • Engine • Clutch • Gearbox • Differential • PTO • Steering • Brake • Hydraulic • Rear linkages • Tyres Explain functions of tractor components • Engine(Cylinder block, pistons, crankshaft) • Powertrain(Clutch, gearbox, differential)	White Board Multi media Textbooks Computer Internet Diagrams Charts Markers	Identify components of a tractor List functions of each tractor components	Guide trainees to: Recognize components of a tractor Identify functions of each tractor components	Tractor Complete engine Gearbox Axles Clutch plate PTO Steering Linkages Tyres

	• Power take-off (PTO) • Steering(Mechanical, Hydraulic, hydraulically assisted) • Brake(Foot, Parking) • Hydraulic(Pump, Cylinders, control valves) • Rear linkages(Three-point hitch, control arms) • Tyres (Front & Rear)	• Power take-off(PTO) • Steering(Mechanical, Hydraulic, hydraulically assisted) • Brake(Foot, Parking) • Hydraulic(Pump, Cylinders, control valves) • Rear linkages(Three-point hitch, control arms) • Tyres (Front & Rear)				

GENERAL OBJECTIVE 2.0: Understand the function of tractor engine.						
	2.1 Describe tractor engine parts • Cylinder block • Pistons • Crankshaft 2.2 Define internal combustion 2.3 Describe internal combustion engine	Explain tractor engine parts • Cylinder block • Pistons • Crankshaft Explain internal combustion	White Board Multi media Textbooks Computer Internet Diagrams Charts Markers	Identify tractor engine parts • Cylinder block • Pistons • Crankshaft Identify internal combustion engine	Guide trainees to: Identify tractor engine parts • Cylinder block • Pistons • Crankshaft ,,,,,,, Identify internal combustion engine	Cylinder block Pistons Crankshaft Radiator Cooling fan Water pump Fuel pump Fuel injection system

	2.4 Describe the layout of an internal combustion engine. 2.5 Describe the: • Compression ignition • Compression ratio • Compression pressure. 2.6 Describe the lubrication system of Tractor engine • Oil pump • Oil filter • Oil galleries 2.7 Describe the various types of oil and their viscosities 2.8 State the factors affecting oil	Explain internal combustion engine Explain the layout of an internal combustion engine. Explain the: • Compression ignition • Compression ratio • Compression pressure. Explain the lubrication system of Tractor engine • Oil pump • Oil filter • Oil galleries Explain the various types of oil and their viscosities Explain the factors affecting oil deterioration – long usage contaminants		Know the layout of an internal combustion engine. Know the compression ignition, compression ratio, compression pressure. Identify the lubrication system of Tractor engine Identify the various types of oil and their viscosities List the factors affecting oil deterioration – long usage contaminants	Identify the : An internal combustion engine. A compression ignition, compression ratio, and compression pressure. Recognize the lubrication system of Tractor engine Identify the various types of oil and their viscosities Identify the factors Recognize the various types of oil and their viscosities Identify factor that	Filtration system Oil pump Oil filter Oil galleries

	deterioration – long usage contaminants. 2.9 Describe the cooling system of tractor engine • Radiator • Cooling fan • Water pump 2.10 Describe the fuel system of a tractor engine • Fuel pump • Fuel injection system • Filtration system 2.11 Define the principle of fuel injection 2.12 Explain the different types of injection pumps	Explain the cooling system of tractor engine • Radiator • Cooling fan • Water pump Explain the fuel system of a tractor engine • Fuel pump • Fuel injection system • Filtration system Explain the principle of fuel injection Explain the different types of injection pumps		Know the cooling system of tractor engine Recognize fuel system of a tractor engine Identify different types of injection pumps	affect oil deterioration – long usage contaminants Identify the cooling system of tractor engine Identify the fuel system of a tractor engine Identify the different types of injection pumps	

GENERAL OBJECTIVE 3.0: Understand the functions of Powertrain (Clutch, gearbox, differential)						
3-4	3.1 Define clutch system	Explain clutch system Explain clutch system operations	White Board Multi media Textbooks Computer			Plate Cylinders

	3.2 Describe clutch system operations 3.3 Describe Clutch system parts • Plate • Cylinders • Pressure disc 3.4 Describe types of clutch • Fluid coupling • Friction clutch • Dog clutch 3.5 Describe gearbox system 3.6 Differentiate between manual and automatic gear box 3.7 Describe types of gearbox • Constant Mesh Type Transmission • B. Selective Sliding Type 3.8 Describe main features of selective sliding gear type.	Explain Clutch system parts • Plate • Cylinders • Pressure disc Explain types of clutch • Fluid coupling • Friction clutch • Dog clutch Explain gearbox system Explain between manual and automatic gear box Explain types of gearbox • Constant Mesh Type Transmission • B. Selective Sliding Type Explain main features of selective sliding gear type. • Fear shifting	Internet Diagrams Charts Markers	List Clutch system parts List types of clutch Know gearbox system Identify the differences between manual and automatic gear box List types of gearbox List features of selective sliding gear type.	Identify Clutch system parts Identify types of clutch Identify gearbox system Differentiate between manual and automatic gear box Identify types of gearbox Identify features of selective sliding gear type.	Pressure disc Fluid coupling Friction clutch Dog clutch Gearbox system Constant Mesh Type Transmission B. Selective Sliding Type Crown wheel Half shaft and Differential casing Differential pinion Bevel gear

	• Fear shifting • Gaer housing • Main shaft • Output shaft • Countershaft or layshaft 3.9 Describe differential unit 3.10 Describe differential unit components • Crown wheel • Half shaft and • Differential casing • Differential pinion • Bevel gear	• Gaer housing • Main shaft • Output shaft • Countershaft or layshaft Explain differential unit Explain differential unit components • Crown wheel • Half shaft and • Differential casing • Differential pinion • Bevel gear		Identify differential unit List differential unit components	Recognize differential unit List identify differential unit components	

GENERAL OBJECTIVE 4.0: Understand the tractor steering and suspensions system						
5-6	4.1 Define steering 4.2 Describe steering system of a tractor • Steering gearbox • Centre link • Pitman arm • Idler arm • Tie rod	Explain steering Explain steering system of a tractor • Steering gearbox • Centre link • Pitman arm • Idler arm • Tie rod	White Board Multi media Textbooks Computer Internet Diagrams Charts Markers	Identify a steering Identify steering system of a tractor	Guide trainees to: Recognize a steering Recognize steering system of a tractor Recognize mechanical steering.	Steering gearbox Centre link Pitman arm Idler arm Tie rod Rack and pinion assembly

	4.3 Describe mechanical steering. 4.4 Describe hydraulic steering 4.5 Describe hydraulically operated steering 4.6 Describe the rack and pinion steering system • Rack and pinion assembly • Bellows boots • Tie rods 4.7 Describe suspension system of a tractor • Control arm • Ball joints • Springs(coil or leaf) • Shock absorbers • Struts	Explain mechanical steering. Explain hydraulic steering Explain hydraulically operated steering Explain the rack and pinion steering system • Rack and pinion assembly • Bellows boots • Tie rods Explain suspension system of a tractor • Control arm • Ball joints • Springs(coil or leaf) • Shock absorbers • Struts		Identify mechanical steering. Identify hydraulic steering Identify hydraulically operated steering Identify the rack and pinion steering system Identify suspension system of a tractor	Recognize hydraulic steering Recognize hydraulically operated steering Recognize the rack and pinion steering system Recognize suspension system of a tractor	Bellows boots Control arm Ball joints Springs(coil or leaf) Shock absorbers

GENERAL OBJECTIVE 5.0: Understand the Tractor Hydraulic system (Pump, Cylinders, control valves)						
7-8	5.1 Describe hydraulic working principle	Explain hydraulic working principle	White Board Multi media		Guide trainees to:	Hydraulic pump

	5.2 Describe basic components of hydraulic system • Hydraulic pump • hydraulic Cylinder and piston • Control valve • Safety valve • Hose pipe and fittings • Lifting arms 5.3 Describe type of hydraulic system • Position control • Draft control • Mixed control 5.4 Describe hitch and control board of tractor hitch • Draw bar hitch • Three-point linkage 5.5 Describe the advantages of three-point linkage	Explain basic components of hydraulic system • Hydraulic pump • hydraulic Cylinder and piston • Control valve • Safety valve • Hose pipe and fittings • Lifting arms Explain type of hydraulic system • Position control • Draft control • Mixed control Explain hitch and control board of tractor hitch • Draw bar hitch • Three-point linkage Explain the advantages of three-point linkage	Textbooks Computer Internet Diagrams Charts Markers	List basic components of hydraulic system List type of hydraulic system Identify hitch and control board of tractor hitch	Identify basic components of hydraulic system Identify type of hydraulic system Recognize hitch and control board of tractor hitch	hydraulic Cylinder and piston Control valve Safety valve Hose pipe and fittings Lifting arms Position control Draft control Mixed control

GENERAL OBJECTIVE 6.0: Understand the basic working principles of tractor braking system						
9-10	6.1 Describe braking system of a tractor 6.2 Describe the principle of operation of tractor braking system 6.3 Classify tractor braking system • Mechanical brake • Hydraulic brake	Explain braking system of a tractor Explain the principle of operation of tractor braking system Explain tractor braking system • Mechanical brake • Hydraulic brake	White Board Multi media Textbooks Computer Internet Diagrams Charts Markers	Identify braking system of a tractor Identify operations of tractor braking system	Guide trainees to: Identify braking system of a tractor Identify operations of tractor braking system	Mechanical brake Hydraulic brake
	Coursework	Course Test 20%	Practical 40%	Other: Examination/Project 40%		

<table>
<tr><td colspan="3">PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE</td></tr>
<tr><td>MODULE: TRANSMISSION SYSTEM I</td><td>SUBJECT CODE: CAM 232</td><td>CONTACT HOURS:</td></tr>
<tr><td>YEAR: 2 TERM: 3</td><td rowspan="2">PRE: REQUISITE:</td><td>THEORETICAL:</td></tr>
<tr><td></td><td>PRACTICAL:</td></tr>
<tr><td colspan="3">GOAL: This module is aimed at providing the trainee with the knowledge and skills of tractor transmission systems maintenance</td></tr>
<tr><td colspan="3">GENERAL OBJECTIVE: On completion of this module, the trainee should be able to:

1.0 Understand tractor transmission systems and its components
2.0 Know the working principles, maintenance and adjustment of clutches.
3.0 Know the working principles and maintenance of drives and couplings.
4.0 Know the function and working principles of bearings in a transmission system.
6.0 Know types of seals and gaskets used on tractor transmission</td></tr>
</table>

PROGRAMME: NTC AND ANTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE						
MODULE: TRANSMISSION SYSTEM I			**COURSE CODE:** CAM 232		**CONTACT HOURS:**	
					THEORETICAL	
YEAR: 2	**TERM:** 3		**PRE: REQUISITE:** CAM 131		**PRACTICAL:**	
GOAL: This module is aimed at providing the trainee with the knowledge and skills of tractor transmission systems maintenance						
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
GENERAL OBJECTIVE 1.0: Understand tractor transmission systems and its components						
WEEK	**SPECIFIC LEARNING OUTCOME**	**TEACHERS ACTIVITIES**	**RESOURCES**	**SPECIFIC LEARNING OBJECTIVES**	**TEACHERS ACTIVITIES**	**RESOURCES**
1-2	1.1 Define Transmission 1.2 Discuss functions of tractor transmission system 1.4 Discuss types of transmission system 1.4 Discuss components of transmission: • Internal components • External components 1.5 Describe functions of the transmission system:	Explain transmission Explain functions of tractor transmission system Explain types of transmission systems Explain components of transmission: • Internal components • External Explain components of transmission: • Internal components • External components	Charts White Board Slides Computer Internet Drawings Projector Markers Multimedia	List types of transmission system List components of transmission system	Guide trainees to; Identify types of transmission system Identify components of the transmission system .	Tractor with good transmission system Implement (trailed, mounted, PTO driven implement) Dismantled tractor engine and transmission system

	• Clutch release • PTO operation • Hydraulic operation	Explain functions of the transmission system: • Clutch release • PTO operation • Hydraulic operation		,,,,,,, .	,,,,,,,,	

GENERAL OBJECTIVE 2.0: Know the working principles, maintenance and adjustment of clutches.						
3-4	2.1 Explain clutch system 2.2 Explain categories of clutches: • Positive clutch • Friction clutch 2.3 Explain types of clutches : • Single plate • Multi-plate • Oil clutch • Hydraulic clutch • Mechanical clutch 2.4 Explain the principles of clutch operation 2.5 Explain clutch assembly 2.6 Discuss components of	Explain the clutch system Explain categories of clutches: • Positive clutch • Friction clutch Explain types of clutches: • Single plate • Multi-plate • Oil clutch • Hydraulic clutch • Mechanical clutch Explain the principles of clutch operation. Describe clutch assembly.	Charts White Board Slides Computer Internet Drawings Projector Markers Multimedia	Identify categories of clutch systems List types of clutches Identify clutch assembly	Recognize clutch assembly Identify clutch components	Tractor with good transmission Different clutch type Complete Clutch Assembly system Clutch test bench Clutch jig Hand tools Mechanical Tool box

	clutch assembly 2.7 Describe the terms: • Spring pressure • Spring compression 2.8 Describe the different types of tools used in clutch maintenance e.g.: • Clutch jig • Hand tool etc.	Explain components of clutch assembly Explain the terms: • Spring pressure • Spring compression Explain the different types of tools used in clutch maintenance e.g.: • Clutch jig • Hand tool etc.		List clutch components List the different types of tools used in clutch maintenance Remove clutch assembly Dismantle/ assemble clutch assembly Set spring pressure and test compression of spring. Repair and /or replace worn or damaged parts.	Identify the different types of tools used in clutch maintenance Remove clutch assembly Dismantle/ assemble clutch assembly Set spring pressure and test compression of spring. Repair and /or replace worn or damaged parts. Carryout maintenance on a tractor clutch	

GENERAL OBJECTIVE 3.0: Know the working principles and maintenance of drives and couplings.						
5 - 7	3.1 Define drives and couplings 3.2 Describe types of drives: • Tabular and solid shaft with universal joints, hubs and driving flanges • Gears • Sprockets • Chain and pulley drives 3.3 Describe types of couplings: • Flexible • Rigid • Flanged 3.4 Describe drives and couplings arrangement 3.5 Describe the adjustment of drives and couplings 3.6 Describe maintenance of drives and couplings	Explain drives and couplings Explain types of drives: • Tabular and solid shaft with universal joints, hubs and driving flanges • Gears • Sprockets • Chain and pulley drives Explain types of couplings: • Flexible • Rigid • Flanged Explain drives and couplings arrangement Explain the adjustment of drives and couplings. Explain maintenance of drives and couplings	Charts White Board Slides Computer Internet Drawings Projector Markers Multimedia	List types of drives And couplings Identify drive and coupling arrangement Carry out adjustments of drives and couplings Carry out maintenance • Remove and replace damaged and worn out parts • Lubrication.	Guide student to; Identify types of drives and couplings Recognize drive and coupling arrangement Conduct adjustments of drives and couplings Conduct maintenance on drive and couplings	Dismantled Gear box Transmission drive (belt and pulley arrangement) PTO shaft with universal joint coupling Hand tools Lubricating Grease and oil

				Sketch simple drive and coupling arrangement Carry out adjustment of line and coupling using a PTO drive	• Remove and replace damaged and worn out parts • Lubrication Sketch simple drive and coupling arrangement Carry out adjustment of line and coupling using a PTO drive	

GENERAL OBJECTIVE 4.0: Know the function and working principles of bearings in a transmission system.						
8-10	4.1 Define friction and lubrication. 4.2 Explain reason for lubrication 4.3 Explain the effects of friction and lubrication on moving or sliding parts 4.4 Define Bearings 4.5 Discuss types of bearings and their functions e.g.: • Ball bearing	Explain friction and lubrication Explain reason for lubrication Explain effects of friction and lubrication on moving or sliding parts Explain Bearings Explain types of bearings and their functions e.g.: • Ball bearing	Charts White Board Slides Computer Internet Drawings Projector Markers Multimedia	List different types of bearings.	Guide trainees to; Identify the different types of bearing	Bearings of different types and shapes sliding Engine parts (piston, cylinder wall) Hand tools Lubricating oil Grease

	• Roller bearings • Shell bearing • Bushings. 4.6 Discuss functions of bearings 4.7 Explain types of transmission oil and grease. 4.8 Discuss the maintenance of bearing	• Roller bearings • Shell bearing • Bushings. . Explain functions of bearings Explain types of transmission oil and greases. Explain the maintenance of bearing		Identify different types of transmission oil and greases. Identify defective bearings due to improper lubrication/ maintenance Visually check for wear and replace worn bearings.	Recognize types of transmission oil and greases Recognize defective bearings due to improper lubrication/ maintenance Visually check for wear and replace worn bearings.	

GENERAL OBJECTIVE 4.0: Know types of seals and gaskets used on tractor transmission						
10-12	5.1 Discuss seals 5.2 Explain types of seals: • Metallic seals • Non-metallic • 'O'ring seals • Gasket • Dust excluders	Explain seals Explain types of seals: • Metallic seals • Non-metallic • 'O'ring seals • Gasket • Dust excluders	Charts White Board Slides Computer Internet Drawings Projector Markers Multimedia		Guide trainees to;	Hand Tools Seals Gaskets Gasket Marker

	• Sealing rings • Lubricant boots. 5.3 Explain the function of seals in the transmission system. 5.4 Discuss types of gasket materials: • Cork • Paper • Felt 5.5 State the function of gasket. 5.6 Describe production gaskets 5.7 Explain use of seals and gaskets	• Sealing rings • Lubricant boots. Explain functions of seals in the transmission system. Describe types of gasket materials: • Cork • Paper • Felt Explain the function of gasket. Explain production of gaskets Explain use of seals and gaskets		List different types of seals List the functions of the seals Identify different gasket materials Cut gasket of various shapes and sizes Know where gaskets are used. Carry out replacement of damaged and /or worn out seals.	Identify different types of seals Identify the functions of the seals Recognize different gasket materials Cut gasket of various shapes and sizes Recognize where gaskets are used. Carry out replacement of damaged and /or worn out seals. Carry out use of gaskets on	Gum/ Adhesives

				Carry out use of gaskets on machine components/parts.	machine components/parts	
	ASSESSMENT CRITERIA					
	Coursework	Course Test 20%	Practical 40%	Other: Examination/Project 40%		

<table>
<tr><td colspan="3">PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE</td></tr>
<tr><td>MODULE: TRACTOR UNDERCARRIAGE</td><td>SUBJECT CODE: CAM 233</td><td>CONTACT HOURS:</td></tr>
<tr><td>YEAR: 2 TERM: 3</td><td rowspan="2">PRE: REQUISITE: CAM 131</td><td>THEORETICAL:</td></tr>
<tr><td></td><td>PRACTICAL:</td></tr>
<tr><td colspan="3">GOAL: This module is designed to provide the trainee with knowledge and skills required to efficiently maintain, diagnose, and repair tractor undercarriage systems.</td></tr>
<tr><td colspan="3">GENERAL OBJECTIVE: On completion of this module, the trainee should be able to:

1.0 Understand Tractor Undercarriages, components and functions
2.0 Understand the working and operating principles of steering boxes, steering linkages.
3.0 Understand working and operating principles of suspension system and attached components
4.0 Understand the hydraulic steering unit, servo assisted brakes and carry out routine maintenance of the components.
5.0 Understand the working principles of the brakes systems and carry out routine maintenance of brake systems.</td></tr>
</table>

PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE						
MODULE: TRACTOR UNDERCARRIAGE			**COURSE CODE:** CAM 233		**CONTACT HOURS:**	
					THEORETICAL:	
YEAR: 2	**TERM:** 3		**PRE: REQUISITE:** CAM 131		**PRACTICAL:**	
GOAL: This module is designed to provide the trainee with knowledge and skills required to efficiently maintain, diagnose, and repair tractor undercarriage systems.						
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
GENERAL OBJECTIVE 1.0: Understand Tractor Under Carriages, components and functions.						
WEEK	**SPECIFIC LEARNING OUTCOME**	**TEACHERS ACTIVITIES**	**RESOURCES**	**SPECIFIC LEARNING OBJECTIVES**	**TEACHERS ACTIVITIES**	**RESOURCES**
1-2	1.1 Define Tractor Under Carriage 1.2 Discuss components of undercarriage such as: • Tracks • Rollers • Sprockets • Idlers 1.3 Know specific functions of the components listed in 1.2 above 1.4 Distinguish between different components in 1.2 above	Explain Tractor Under Carriage Explain components of undercarriage such as: • Tracks • Rollers • Sprockets • Idlers Explain specific functions of the components listed in 1.2 above Distinguish between different components in 1.2 above	Marker White Board Textbooks Computer Internet Projector Slides Diagrams Charts	List the functions of the undercarriage system. List the major components of undercarriage	Guide trainees to: Recognize the functions of the undercarriage system. Identify major components of undercarriage	PPE Safety drills Workshop tools Grease

GENERAL OBJECTIVE 2.0**:** Understand the working and operating principles of steering boxes, steering linkages.						
3- 4	2.1 Define a steering box 2.2 Explain the working principles of steering box. 2.3 Explain how to carry out steering adjustment using the: • Caster • Comber • Wheel alignment gauge. 2.4 Explain how to diagnose and rectify faults in steering boxes. 2.5 Explain how to carry out routine maintenance of a steering system	Explain a steering box Explain the working principles of steering box. Explain how to carry out steering adjustment using the: • Caster • Comber • Wheel alignment gauge. Explain how to diagnose and rectify faults in steering boxes. Explain how to carry out routine maintenance of a steering system	Marker White Board Textbooks Computer Internet Projector Slides Diagrams Charts	Identify Tractor Steering box Remove, dismantle, assemble and install steering boxes. Carry out steering adjustment using the caster and camber instruments and wheel alignment gauge. Find out faults and rectify faults in steering boxes. Carry out routine maintenance of steering system.	Guide trainees to: Identify Tractor Steering box Dismantle, assemble and install steering boxes. Carry out steering adjustment using the caster and camber instruments and wheel alignment gauge. Diagnose and rectify faults in steering boxes. Conduct routine maintenance of steering system.	PPE Steering box Caster and Camber instrument Laser Alignment gauge Workshop tools Lubricant (Grease)

GENERAL OBJECTIVE 3.0: Understand working and operating principles of suspension system and attached components.						
5-7	3.1 Define Suspension system 3.2 Discuss different types of suspension system: • Solid • Liquid • Pneumatic suspensions 3.3 Explain the working principles of: • Solid • Liquid • Pneumatic suspensions 3.4 Describe the different types of spring: • Leaf springs • Torsion bar • Coil spring • Rubber spring. 3.5 Describe the different types of wheels, rims and tire ply ratings.	Explain Suspension system Explain different types of suspension system: • Solid • Liquid • Pneumatic suspensions Explain the working principles of: • Solid • Liquid • Pneumatic suspensions Explain the different types of spring: • Leaf springs • Torsion bar • Coil spring • Rubber spring. . Explain the different types of wheels, rims and tire ply ratings.	Marker White Board Textbooks Computer Internet Projector Slides Diagrams Charts	List the different types of spring List different types of wheels, rims and tire ply ratings. Remove, disassemble, assemble, and install suspensions.	Guide trainees to: Identify the different types of spring Identify different types of wheels, rims and tire ply ratings. Dismantle, disassemble, assemble, and install suspensions.	Trolley jack Axle stand Wooden stand Hydraulic jack Suspension pads

				Change worn out or damaged parts of line suspension such as springs, dampers and shaft.	Replace worn out or damaged parts of line suspension such as springs, dampers and shaft.	

GENERAL OBJECTIVE 4.0: Understand the hydraulic steering unit, servo assisted brakes and carry out routine maintenance of the components.						
8-9	4.1 Define the hydraulic system 4.2 Describe the following parts of the hydraulic system: • Hydraulic pump • Hydraulic piston • Hydraulic cylinder • Hydraulic line • Pipes • Seal • Ram	Explain the hydraulic system Explain the following parts of the hydraulic system: • Hydraulic pump • Hydraulic piston • Hydraulic cylinder • Hydraulic line • Pipes • Seal • Ram	Marker White Board Textbooks Computer Internet Projector Slides Diagrams Charts	List the following parts of the hydraulic system: • Hydraulic pump • Hydraulic piston • Hydraulic cylinder • Hydraulic line • Pipes • Seal • Ram Remove, service and install pumps	Guide trainees to: Identify the following parts of the hydraulic system: • Hydraulic pump • Hydraulic piston • Hydraulic cylinder • Hydraulic line • Pipes • Seal • Ram	Hydraulic pump Puller Hydraulic oil Hydraulic Filter Waste cloth Seals ‘O’ rings Hydraulic pipes

	4.3 Discuss the working principles of tractor hydraulic system transmitting force, pump, seal and valves, filters and hydraulic accumulators	Explain the working principles of tractor hydraulic system transmitting force, pump, seal and valves, filters and hydraulic accumulators		Remove and discard used seals and install new seals and valves	Remove, service and install pumps Remove and discard used seals and install new seals and valves	

GENERAL OBJECTIVE 5.0: Understand the working principles of the brakes systems and carry out routine maintenance of brake systems.						
10-12	5.1 Define the braking system of a tractor 5.2 Discuss different types of braking system 5.3 Discuss the working principles of different types braking systems 5.4 Explain the routine maintenance of hydraulic circuit of braking system:	Explain the braking system of a tractor Explain different types of braking system Explain the working principles of different types of braking system	Marker White Board Textbooks Computer Internet Projector Slides Diagrams Charts	Carryout overhaul Remove, install, dismantle and assemble braking system. Carry out routine maintenance of	Guide trainees to: Demonstrate overhauling Remove, install, dismantle and assemble braking system. Conduct routine maintenance of	- Brake fluid - Special spammers - Brake fluids-Brake lining - Brake pads - Brake drum - Seals - Air valves

	• Adjustment • Bleeding of hydraulic	Explain the routine maintenance of hydraulic circuit of braking system: • Adjustment • Bleeding of hydraulic		hydraulic circuit of braking system. Change brake linings, brake pads and inspect brake drum. Identify brake pneumatic system. Maintain brake pneumatic system. Carry out efficiency test of braking system.	hydraulic circuit of braking system. Change brake linings, brake pads and inspect brake drum. Identify brake pneumatic system. Maintain brake pneumatic system. Conduct efficiency test of braking system.	
	ASSESSMENT CRITERIA					
	Coursework	Course Test 20%	Practical 60%	Other: Examination/Project 20%		

<table>
<tr><td colspan="3">PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE</td></tr>
<tr><td>MODULE: IRRIGATION EQUIPMENT</td><td>SUBJECT CODE: CAM 234</td><td>CONTACT HOURS:</td></tr>
<tr><td>YEAR: 2 TERM: 3</td><td rowspan="2">PRE: REQUISITE:</td><td>THEORETICAL:</td></tr>
<tr><td></td><td>PRACTICAL:</td></tr>
<tr><td colspan="3">GOAL: This module is aimed at trainees with the knowledge and skills of irrigation systems and its maintenance</td></tr>
<tr><td colspan="3">GENERAL OBJECTIVE: On completion of this module, the trainee should be able to:

1.0 Understand working of irrigation system and perform routine maintenance
2.0 Understand trouble shooting technique and maintenance of irrigation system
3.0 Know the components of irrigation system and perform maintenance</td></tr>
</table>

PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE						
MODULE: IRRIGATION EQUIPMENT			**COURSE CODE:** CAM 234		**CONTACT HOURS:**	
					THEORETICAL:	
YEAR: 2	**TERM** 3		**PRE REQUISITE:**		**PRACTICAL:**	
GOAL: This module is aimed at trainees with the knowledge and skills of irrigation systems and its maintenance						
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
GENERAL OBJECTIVE 1.0: Understand working of irrigation system and perform routine maintenance						
WEEK	**SPECIFIC LEARNING OUTCOME**	**TEACHERS ACTIVITIES**	**RESOURCES**	**SPECIFIC LEARNING OBJECTIVES**	**TEACHERS ACTIVITIES**	**RESOURCES**
1-4	1.1 Define irrigation 1.2 Define importance of irrigation in agriculture. 1.3 Discus types of irrigation systems e.g.: • Surface • Sprinkler • Drip 1.4 Describe the components of an irrigation system e.g.: • Pumps • Pipes • Valves • Emitters. 1.5 Explain the operation of an irrigation system e.g.: • Setting up • Scheduling • Monitoring	Explain Irrigation Explain the role of irrigation in agriculture Explain types of irrigation systems e.g.: • Surface • Sprinkler • Drip Explain the components of an irrigation system e.g.: • Pumps • Pipes • Valves • Emitters. Explain the operation of an irrigation system e.g.: • Setting up • Scheduling • Monitoring	Charts Drawings Internet Computer Projector Textbooks Markers White board Multi media	List irrigation system components. Identify different irrigation systems for various crops.	Guide trainees to : Identify irrigation system components Recognize different irrigation	Pumps Pipes Valves Emitters.

	• Water distribution. 1.6 Discuss routine maintenance tasks on irrigation systems e.g.: • Cleaning filters • Checking for leaks	• Water distribution. Explain routine maintenance tasks for irrigation systems e.g.: • Cleaning filters • Checking for leaks		Performing routine maintenance tasks on irrigation systems Demonstrate the operation of an irrigation system	systems for various crops. Conduct routine maintenance tasks on irrigation systems Demonstrate the operation of an irrigation system	
GENERAL OBJECTIVE 2.0: Understand trouble shooting technique and maintenance of irrigation system						
5-8	2.1 Discuss common problems in irrigation systems and their causes e.g.: • Clogging • Pressure issues. 2.2 Discuss troubleshooting techniques for diagnosing and resolving irrigation issues e.g.: • Checking for leaks • Testing pressure	Explain common problems in irrigation systems and their causes e.g.: • Clogging • Pressure issues. Explain troubleshooting techniques for diagnosing and resolving irrigation issues e.g.: • Checking for leaks	Charts Drawings Internet Computer Projector Textbooks Markers White board Multi media	Diagnose faults by inspection of components Carryout troubleshooting techniques for resolving irrigation issues Dismantle system and fix defective components Carryout hands-on practical tasks related to	Guide trainees to: Find out faults in irrigation system by inspection of components Conduct troubleshooting techniques for resolving irrigation issues Dismantle system and fix defective components	Irrigation system models Maintenance tools (pressure gauges, filter cleaning kits). Replacement parts (filters, emitters, valves). Safety gear (gloves, goggles). Field plots

	2.3 Explain safe and efficient operation of irrigation systems	• Testing pressure Explain safe and efficient operation of irrigation systems		irrigation system operation and maintenance Observe safe and efficient operation of irrigation systems	Carryout hands-on practical tasks related to irrigation system operation and maintenance Demonstrate safe and efficient operation of irrigation systems	
GENERAL OBJECTIVE 3.0: Know the components of irrigation system and carry out maintenance						
9 - 12	3.1 Describe Water Sources e.g.: • Wells • Rivers • Reservoirs 3.2 Explain factors affecting water sources selection e.g.: • Water quality • Availability • Accessibility 3.3 Discuss pumps in irrigation	Explain water sources e.g.: • Wells • Rivers • Reservoirs Explain factors affecting water source selection e.g.: • Water quality • Availability • Accessibility Explain pumps in irrigation	Charts Drawings Internet Computer Projector Textbooks Markers White board Multi media	List types of water sources List types of pumps		Irrigation system models Maintenance tools (pressure gauges, filter cleaning kits). Replacement parts (filters, emitters, valves).

	3.4 Discuss types of pumps: • Centrifugal • Submersible • Turbine. 3.5 Discuss maintenance of pumps: • Regular inspection • Lubrication • Cleaning 3.6 Discuss pipes and tubing 3.7 Explain types of pipes and tubing 3.8 Discuss functions of pipes and tubing 3.9 Discuss maintenance of pipes and tubing: • Fittings • Check for leaks, cracks, and blockages 3.10 Discuss valves 3.11 Discuss functions of valves 3.12 Explain types of valves: • Manual • Automatic	Explain types of pumps: • Centrifugal • Submersible • Turbine. Explain maintenance of pump: • Regular inspection • Lubrication • Cleaning Explain pipes and tubing Explain types of pipes and tubing Describe functions of pipes and tubing Explain maintenance of pipes and tubing: • Fittings • Check for leaks, cracks, and blockages Explain valves Explain functions of valves Explain types of valves:		Identify types of valves	Identify types of valves	Safety gear (gloves, goggles). Field plots

	• Pressure-regulating 3.13 Discuss maintenance of Valves: • Check for leaks • Wear and blockages 3.14 Discuss Emitters/ Sprinklers 3.15 Discuss functions of emitters/sprinkler 3.16 Explain types of emitters/sprinklers: • Drip emitters • Micro-sprinklers • Rotary sprinklers. 3.17 Discuss maintenance of emitters /sprinklers: • Check for leaks • Check for clogging • Check uniform water distribution. 3.18 Explain how to setup irrigation system	• Manual • Automatic • Pressure-regulating Explain maintenance of Valves: • Check for leaks • Wear and blockages Explain Emitters/ Sprinklers Explain functions of emitters/sprinkler Explain types of emitters/sprinklers: • Drip emitters • Micro-sprinklers • Rotary sprinklers. Explain maintenance of emitters /sprinklers: • Check for leaks • Check for clogging • Check uniform water distribution.		List types of emitters/sprinklers List functions of each components Perform maintenance on each of the components	Identify types of emitters/sprinklers Identify functions of each components Conduct maintenance on all the components	

		Explain how to setup irrigation system		Setup and demonstration irrigation system Assemble and install a drip irrigation system in a field plot i.e.: connect the pump, pipes, valves, and emitters.	Setup and demonstration irrigation system Assemble and install a drip irrigation system in a field plot i.e.: connect the pump, pipes, valves, and emitters.	
	ASSESSMENT CRITERIA					
	Coursework	Course Test 30%	Practical 40%	Other: Examination/Project 30%		

PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE						
MODULE: TRANSMISSION SYSTEM II			**COURSE CODE:** CAM 311		**CONTACT HOURS**	
					THEORETICAL:	
YEAR: 3 **TERM:** 1			**PRE: REQUISITE:** CAM232		**PRACTICAL:**	
GOAL: This module is aimed at providing the trainee with the knowledge and skills on maintenance of tractor transmission systems.						
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
GENERAL OBJECTIVE 1.0: Understand the working principles of gears in a transmission system						
WEEK	**SPECIFIC LEARNING OUTCOME**	**TEACHERS ACTIVITIES**	**RESOURCES**	**SPECIFIC LEARNING OBJECTIVES**	**TEACHERS ACTIVITIES**	**RESOURCES**
1-3	1.1 Describe the arrangement of gears in the mechanical gearbox.	Explain the arrangement of gears in the mechanical gearbox.	Charts Drawings Project Computer Internet Internet services Markers White board Multi media	Observe and compare the types of gear systems.	Guide trainees to: Observe and compare the types of gear systems.	Gearbox Hand Tool box Pullers Drifts Punches Spanner
	1.2 Describe tools and equipment used for various jobs on a gear box e.g.: • Pullers • Drifts • Punches • Spanner, etc.	Explain tools and equipment used for various jobs on a gear box e.g.: • Pullers • Drifts • Punches • Spanner, etc.		Identify the tools and equipment used for various jobs on a gear box	Recognize the various tools and equipment used for various jobs on a gear box	
	1.3 Explain the process of removing gearbox	Explain the process of removing gearbox		• Remove gearbox from a vehicle. • Dismantle, inspect for wear of gear teeth, bushings, shafts and assemble the gear box	• Remove gearbox from a vehicle. • Dismantle, inspect for wear of gear teeth, bushings, shafts and assemble the gear	

	1.4 Explain the importance of checking and identifying the correct lubrication fluid in the gearbox	Explain the importance of checking and identifying the correct lubrication fluid in the		• Identify tools and equipment used for various jobs on a gear box • Check gear oil level, • Identify the correct (lubricant) grade of oil • Pour oil into the gearbox .	• Select the various tools and equipment used for various jobs on a gear box • Checking gear oil level • Identify the correct (lubricant) grade of oil • ill to the correct	
GENERAL OBJECTIVE 2.0: Understand the working principles and maintenance of a differential and final drives						
4-5	2.1 Define the following: • Final Drive • Differential drive 2.2 Discuss the working principles of a differential	Explain the following: • Final Drive • Differential drive Explain the working principles of a differential	Charts Drawings Project Computer Internet Internet services Markers White board Multi media	Diagnose faults by inspection or road testing Remove differential and final drives	Guide trainees to: Diagnose faults by inspection or road testing Identify differential and final drives	Tractor in the workshop Final Drive Differential Drive Hand tools

	2.3 Describe the working principles of a final drives units. 2.4 Explain the simple line diagram of differential and final drive.	Explain the working principles of a final drives units. Explain simple line diagram of differential and final drive.		Dismantle the gear teeth or the sprockets for wear Assemble differential and final drives. Check, adjust blacklash and other clearance on differential and final drives. Observe the relative position of the differential and final drive on the tractor.	Inspect the gear teeth or the sprockets for wear Assemble differential and final drives. Check, adjust blacklash and other clearance on differential and final drives. Observe the relative position of the differential and final drive on the tractor.	
GENERAL OBJECTIVE 3.0: Understand the working principles and maintenance of the power take off (PTO) drive.						
6-7	3.1 Define power take off, (PTO) drive. 3.2 Explain the working principle of a power take off, (PTO) drive 3.3 Explain the types of PTO drives (540, 1000RPM) 3.4 Describe the routine maintenance and removal or replacement of worn out or damaged parts	Explain PTO drive and its working principle. Describe the types of power take off, (PTO) drive Explain the routine maintenance and removal or replacement of worn out or damaged parts.	Charts Drawings Project Computer Internet Internet services Markers White board Multi media	Observe the location of PTO on the tractor Identify the types of PTO drives (540 and 1000 RPM) Disassemble, inspect gears and shaft for wear and assemble a PTO unit	Guide the trainee to Observe the location of PTO on the tractor Recognize the types of PTO drives (540 and 1000 RPM) Dismantle, inspect gears and shaft for wear and assemble a PTO unit	Tractor in the workshop Dismantled PTO

	3.5 Describe simple line diagrams of power take off units to show independent and ground speed drives	Explain simple line diagrams of power take off units to show independent and ground speed drives		Carry out routine maintenance and removal or replacement of worn out or damaged parts. Draw simple line diagrams of power take off units to show independent and ground speed drives	Inspect and carry out routine maintenance and removal or replacement of worn out or damaged parts. Make simple line diagrams of power take off units to show independent and ground speed drives	
GENERAL OBJECTIVE 4.0: Know the working principle and maintenance of tractor hydraulic systems.						
11-12	4.1 Define hydraulic system 4.2 Discuss the working principles of a hydraulic system. 4.3 State the components of the hydraulic system on a tractor • Pump • Control valves • Pistons • Reservoirs • Filters. 4.4 Discuss the functions of each components of the hydraulic system on a tractor	Explain what is hydraulic system Explain the working principles of a hydraulic system. Explain the components of the hydraulic system on a tractor Explain the functions of each components of the hydraulic system on a tractor Explain faulty	Charts Drawings Project Computer Internet Internet services Markers White board Multi media	Identify the various parts of hydraulic system on a tractor. Identify the various parts of hydraulic system on a tractor Diagnose and rectify faulty	Guide the trainee to Identify the various parts of hydraulic system on a tractor. Recognize the various parts of hydraulic system on a tractor. Find out and rectify	Tractor with functioning hydraulic system Hydraulic filter Hydraulic pump of differed types Directional control valve Cylinder Hydraulic hoses and couplings

	4.5 Describe faulty linkage operations. 4.6 Discuss the different types of hydraulic hoses and couplings 4.7 Discuss the significance of proper selection of hydraulic hoses and couplings.	linkage operations. Explain the different types of hydraulic hoses and couplings Explain the significance of proper selection of hydraulic hoses and couplings.		linkage operations. choose proper hydraulic hoses and coupling	faulty linkage operations Select proper hydraulic hoses and coupling	
GENERAL OBJECTIVE 5.0: Know the working principles of hitches – single hitches, double hitches, three point hitches systems						
8-10	5.1 State the working principles of hitches in a transmission system. 5.2 Discuss the purpose of alternative linkage position 5.3 Describe operation adjustments 5.4 Outline types of top links and stabilizers. 5.5 State different types of drawbars: • Channel • Solid	Explain the working principles of hitches in a transmission system Explain the purpose of alternative linkage position Explain operation adjustments Explain the types of top links and stabilizers. Explain the different types of drawbars: • Channel • Solid • Tabular draw	Charts Drawings Project Computer Internet Internet services Markers White board Multi media	Carry out adjustments transmission system Identify types of top links and stabilizers. Identify different types of drawbars	Guide the trainee to: Carry out operation adjustments transmission system Recognize types of top links and stabilizers. Identify different types of drawbars Carry out routine maintenance of hitches	Tractor Power farming equipment (harrow, ridger, top link) Implement Tractor Crossbar

	• Tabular draw bars. 5.6 Describe the routine maintenance of hitches and attachments 5.7 Describe the simple line diagram of hitches.	bars. Explain the routine maintenance of hitches and attachments Explain the simple line diagram of hitches.		Carry out routine maintenance of hitches and attachments Make simple line diagram of hitches.	and attachments Make simple line diagram of hitches.	
ASSESSMENT CRITERIA						
Coursework	Course Test 20%	Practical 40%	Other: Examination/Project 40%			

<table>
<tr><td colspan="3">PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE</td></tr>
<tr><td>MODULE: AUTO ELECTRICITY</td><td>SUBJECT CODE: CAM 312</td><td>CONTACT HOURS:</td></tr>
<tr><td>YEAR: 3 TERM: 1</td><td rowspan="2">PRE: REQUISITE:</td><td>THEORETICAL:</td></tr>
<tr><td></td><td>PRACTICAL:</td></tr>
<tr><td colspan="3">GOAL: This module is designed to provide the trainees with the fundamentals knowledge and skills of electricity and its application to farm equipment.</td></tr>
<tr><td colspan="3">GENERAL OBJECTIVE: On completion of this module, the trainee should be able to:

1.0 1.0 Understand the layout of electrical system of a vehicle/tractor

2.0 Understand the theory of wet and dry cell batteries

3.0 Understand the starting system.

4.0 Understand the charging system.

5.0 Understand electrical system safety.</td></tr>
</table>

PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE						
MODULE: AUTO ELECTRICITY		**COURSE CODE:** CAM 312		**CONTACT HOURS:** 120		
				THEORETICAL:		
YEAR: 3 **TERM:** 1		**PRE: REQUISITE:** CPH 12		**PRACTICAL:**		
GOAL: This module is designed to provide the trainees with the fundamentals knowledge and skills of electricity and its application to farm equipment.						
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
GENERAL OBJECTIVE 1.0: Understand the layout of electrical system of a vehicle/tractor.						
WEEK	**SPECIFIC LEARNING OUTCOME**	**TEACHERS ACTIVITIES**	**RESOURCES**	**SPECIFIC LEARNING OBJECTIVES**	**TEACHERS ACTIVITIES**	**RESOURCES**
1	1.1 Define electrical terms: • Circuit diagram wires/symbols, • Define ohm's law • Analog/digital multimeters 1.2 Describe tractor circuit diagram: • Wires/terminals • Circuit failure • Relay, circuit breakers & switches 1.3 Describe ignition principles • Ignition system • Secondary resistance cable	Explain electrical terms • Circuit diagram wires/symbols, • Define ohm's law • Analog/digital multimeters Explain tractor circuit diagram: • Wires/terminals • Circuit failure • Relay, circuit breakers & switches Explain ignition principles • Ignition system • Secondary resistance cable	Marker White board Charts Slides Multimedia Textbooks Computer Internet Projector	Identify tractor circuit diagram Identify: • Ignition system • Secondary resistance cable	Guide trainees to: Identify tractor circuit diagram Identify: • Ignition system • Secondary resistance cable	Wires Relays Multimeters Circuit diagram Alternator

	1.4 Describe charging operation principle: • DC generator/regulator components • Alternator charging circuit 1.5 Describe the tractor electrical system. 1.6 Describe failures analysis on components and wiring	Explain charging operation principle • DC generator/regulator components • Alternator charging circuit Explain the tractor electrical system. Explain failures analysis on components and wiring		Carryout charging operation principles of DC generator components and alternator charging circuit Interpret the tractor electrical system. Identify failures analysis on components and wiring	Carryout charging operation principles of DC generator components and alternator charging circuit Read the tractor electrical system. Identify failures analysis on components and wiring	
GENERAL OBJECTIVE 2.0: Understand the theory of wet and dry cell batteries						
2-4	2.1 Describe dry and wet battery cells 2.2 Distinguish between wet and dry cell of a battery 2.3 Describe battery inspection with: • Volt meter • Ampmeter • Ohmmeter • Hydrometer 2.4 Discuss the care of battery terminals	Explain dry and wet battery cells Explain the differences between wet and dry cell of a battery Explain battery inspection with: • Volt meter • Ampmeter • Ohmmeter • Hydrometer Explain the care of battery terminals	Marker White board Charts Slides Multimedia Textbooks Computer Internet Projector	Identify dry and wet battery cells. Identify the differences between wet and dry cell of a battery Carry out battery care Identify different battery terminals	Guide trainees to: Identify dry and wet battery cells Know the differentiate between wet and dry cell of a battery Carry out battery care	Dry and wet batteries Electrolyte Hydrometer Battery charger

	2.5 Differentiate between battery terminals/ports 2.6 Describe ration of electrolyte mix and fill into the battery and carry out its routine maintenance. 2.7 Discuss the components and construction of a battery. 2.8 Describe how to test specific gravity and voltage of a battery. 2.9 Explain the process of charging battery system 2.10 Explain the process of battery storage.	Explain the differences between battery terminals/ports Explain ration of electrolyte mix and fill into the battery and carry out its routine maintenance Explain the components and construction of a battery. Explain how to test specific gravity and voltage of a battery Explain the process of charging battery system Explain the process of battery storage.		Identify ration of electrolyte mix and fill into the battery and carry out its routine maintenance Identify the components and construction of a battery. Carry out measurement of specific gravity and voltage of a battery Carry out charging of battery	Recognize different battery terminals Apply ration of electrolyte mix and fill into the battery and carry out its routine maintenance Know the components and construction of a battery. Demonstrate measurement of specific gravity and voltage of a battery. Demonstrate charging of battery	
GENERAL OBJECTIVE 3.0: Understand the starting system						
5-8	3.1 Describe starting circuit 3.2 List the components of a starter motor.	Explain starting circuit Explain the components of a starter motor	Marker White board Charts Slides		Guide trainees to:	Starter motor Voltage regular

	3.3 Describe process of trouble - Shooting of : • Solenoid, • Armature, • Field winding • Bendix drive. 3.4 Describe the following: • Starting Relay • Voltage regulator • Cranking circuit 3.5 Describe starter motor faults	Explain the process of Trouble shooting of: • Solenoid, • Armature, • Field winding • Bendix drive. .Explain the following: • Starting Relay • Voltage regulator • Cranking circuit Explain starter motor faults	Multimedia Textbooks Computer Internet Projector	Identify the components of a starter motor Identify faulty starter motor Trouble shoot a starter motor system Identify: • Starting Relay • Voltage regulator • Cranking circuit Disassemble service and assemble a starter motor and replace faulty or worn out parts	Recognize the components of a starter motor Repair faulty starter motor Trouble shoot a starter motor system Recognize : • Starting Relay • Voltage regulator • Cranking circuit Assemble service and assemble a starter motor and replace faulty or worn out parts	Solenoid Armature
GENERAL OBJECTIVE 4.0: Know the charging system.						
9-10	4.1 Describe charging operating principles: • Generator/ regulator components • Alternator charging operations etc.	Explain charging operating principles: • Generator/ regulator components • Alternator charging operations etc.	Marker White board Charts Slides Multimedia Textbooks Computer Internet Projector	Identify alternators and dynamos identify various parts.	Guide trainees to: Recognize alternators and dynamos identify various parts.	Alternators Dynamos

	4.2 Distinguish between alternators and generators 4.3 Describe components of alternators: • Brushes • Field winding armature • Commutators 4.4 Describe faulty alternator	Explain the differences between alternators and generators Explain components of alternators: • Brushes • Field winding armature • Commutators Explain faulty alternator		Identify the difference between alternators and generators Carryout minor repairs on alternators Rectify or replace cut out relays and voltage regulators Carryout trouble shooting on alternators	Differentiate the difference between alternators and generators Conduct minor repairs on alternators Rectify or replace cut out relays and voltage regulators Conduct trouble shooting on alternators	Voltage regulator Relays Screwdriver Plier Selotape Multimeter
GENERAL OBJECTIVE 5.0: Know Electrical system safety.						
11-12	5.1 Describe various cranking safety circuits 5.2 Describe safe practice for testing procedures.	Explain various cranking safety circuits Explain safe practice for testing procedures.	Marker White board Charts Slides Multimedia Textbooks Computer Internet	Observe safety during cranking Conduct safe testing	Guide trainees to: Demonstrate safety during cranking Conduct safe testing	Circuit diagram Battery Screwdriver

	5.3 Describe safe battery handling procedures	Explain safe battery handling procedures	Projector	Carry out safe battery testing and handling	Carry out safe battery testing and handling	Avometer Multitester PPE

ASSESSMENT CRITERIA

Coursework	Course Test 20%	Practical 40%	Other: Examination/Project 40%

<table>
<tr><td colspan="3">PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE</td></tr>
<tr><td>MODULE: HARVESTING AND POST HARVESTING</td><td>SUBJECT CODE: CAM 313</td><td>CONTACT HOURS:</td></tr>
<tr><td>YEAR: 3 TERM: 1</td><td rowspan="2">PRE: REQUISITE:</td><td>THEORETICAL:</td></tr>
<tr><td></td><td>PRACTICAL:</td></tr>
<tr><td colspan="3">GOAL: This module is designed to provide the trainee with the knowledge and skills of harvesting and post-harvest technology of agricultural produce.</td></tr>
<tr><td colspan="3">GENERAL OBJECTIVE: On completion of this module, the trainee should be able to:

1.0 Understand the harvesting techniques of agricultural produce.

2.0 Know post-harvest technologies of agricultural produce

3.0 Understand storage structures for crop storage

4.0 Understanding the essential crop storage activities for crops stored.

5.0 Know treatment of crops during storage</td></tr>
</table>

PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE						
MODULE: HARVESTING AND POSTHARVESTING			**COURSE CODE:** CAM 313		**CONTACT HOURS:** 120	
					THEORETICAL:	
YEAR: 3	**TERM:** 3		**PRE: REQUISITE:**		**PRACTICAL:**	
GOAL: This module is designed to provide the trainee with the knowledge and skills of harvesting and post-harvest technology of agricultural produce						
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
GENERAL OBJECTIVE 1.0: Know the harvesting techniques of agricultural produce.						
WEEK	**SPECIFIC LEARNING OUTCOME**	**TEACHERS ACTIVITIES**	**RESOURCES**	**SPECIFIC LEARNING OBJECTIVES**	**TEACHERS ACTIVITIES**	**RESOURCES**
1	1.1 Define Harvesting 1.2 Describe methods of harvesting: • Manual harvesting • Harvesting with hand tools (axe, hoe, sickle etc.) • Machine harvesting 1.3 Describe the basic concepts related to harvesting: • Harvesting • Crop maturity • Maturity indices etc. 1.4 Differentiate crop maturity stages. 1.5 Describe the basic concepts related to crop yields (yield estimation)	Explain Harvesting Explain methods of harvesting: • Manual harvesting • Harvesting with hand tools (axe, hoe, sickle etc.) • Machine harvesting Explain the basic concepts related to harvesting: • Harvesting • Crop maturity • Maturity indices etc. Explain crop maturity stages	Multimedia White board Computer Projector Internet Flipcharts Maker Textbooks	Identify materials, tools and equipment for specific crop harvesting Identify methods of harvesting Identify crop maturity stages	Guide trainees to: Identify materials, tools and equipment for specific crop harvesting Identify methods of harvesting Know crop maturity stages	Logbook Portfolio Axe Hoe Cutlass Combine Harvester Thresher

	1.6 Discuss proper crop harvesting time. 1.7 Discuss harvesting method for specific crop to minimize loses. 1.8 Discuss harvesting practices for specific crop to minimize loses.	Explain the basic concepts related to crop yields (yield estimation) Explain proper crop harvesting time Explain harvesting method for specific crop to minimize looses Explain harvesting practices for specific crop to minimize loses		Identify proper crop harvesting time Know harvesting method for specific crop to minimize looses Know harvesting practices for specific crop to minimize loses	Recognize proper crop harvesting time Identify harvesting method for specific crop to minimize looses Identify harvesting practices for specific crop to minimize loses	
GENERAL OBJECTIVE 2.0: Understand post-harvest technology of agricultural produce						
6	2.1 Define: • Postharvest handling • Postharvest technology 2.2 Describe the importance of postharvest techniques	Explain: • Postharvest handling • Postharvest technology Explain the importance of postharvest techniques	Multimedia White board Computer Projector Internet Flipcharts Maker Textbooks	Identify postharvest handling and postharvest technology Know postharvest techniques	Guide trainees to: Identify postharvest handling and postharvest technology Identify postharvest techniques	Tarpaulin Mats driers Winnower Sieves De-stoner

	2.3 Describe equipment and material used for postharvest operations of crops: • Tarpaulin • Mats machine driers • Winnower • Sieves • Destoner • Washers • Sticks • Mechanical sheller • Thresher • Bags/sacks • Plastic and wooden crates • Silo • Hermetic bags • Underground pits, etc. 2.4 Describe the postharvest techniques for different crops 2.5 Describe the facilities use for post harvesting operations techniques for different crops	Explain equipment and material used for postharvest operations of crops: • Tarpaulin • Mats machine driers • Winnower • Sieves • Destoner • Washers • Sticks • Mechanical sheller • Thresher • Bags/sacks • Plastic and wooden crates • Silo • Hermetic bags • Underground pits, etc. Explain the postharvest techniques for different crops Explain the facilities use for post harvesting operations techniques for different crops		Identify equipment and material used for postharvest operations of crops Know the postharvest techniques for different crops	Recognize equipment and material used for postharvest operations of crops Carry out the postharvest techniques for different crops	Washers Sticks Mechanical sheller Thresher Bags/sacks Plastic and wooden crates Silo Hermetic bags

	2.6 Describe common post-harvest operations for crops 2.7 Describe postharvest procedures for: • Cereals • Legumes • Roots and tuber crops 2.8 Describe the procedure for grain treatment	Explain common post-harvest operations for crops Explain postharvest procedures for: • Cereals • Legumes • Roots and tuber crops Explain the procedure for grain treatment		Identify the facilities use for post harvesting operations Identify common post-harvest operations for crops Identify postharvest procedures for: • Cereals • Legumes • Roots and tuber crops Identify the procedure for grain treatment	Recognize the facilities use for post harvesting operations Carry out common post-harvest operations for crops Identify postharvest procedures for: • Cereals • Legumes • Roots and tuber crops Recognize the procedure for grain treatment	
GENERAL OBJECTIVE 3.0: Understand storage structures for crop storage						
7	3.1 Define storing 3.2 Define terms related to storing of different crops storage 3.3 Describe the various crop storage structures: • Traditional • Modern/ improved 3.4 Describe the types of crop storage structures	Explain storing Explain terms related to storing of different crops storage Explain the various crop storage structures: • Traditional • Modern/ improved	Multimedia White board Computer Projector Internet Flipcharts Maker Textbooks	Identify the various crop storage structures	Guide trainees to: Recognize the various crop storage structures	Silo Rhombus

	3.5 Describe the features /criteria to consider for best crop storage 3.6 Describe conditions necessary for good storage	Explain the types of crop storage structures Explain the features /criteria to consider for best crop storage Explain conditions necessary for good storage		Identify the types of crop storage structures Know the features /criteria to consider for best crop storage structures Know conditions necessary for best crop storage	Recognize the types of crop storage structures Recognize the features /criteria to consider for best crop storage structures Identify conditions necessary for best crop storage	
GENERAL OBJECTIVE 4.0: Understanding the essential crop storage activities for crops stored.						
8-12	4.1 Define terms related to management of crop produce in a store: • Fumigation • Fumigants 4.2 Describe the fumigation process 4.3 Describe the types of fumigants 4.4 State the advantages and disadvantages of fumigants 4.5 Describe factors for success and failure for fumigation	Explain terms related to management of crop produce in a store: • Fumigation • Fumigants Explain the fumigation process Explain the types of fumigants Explain the advantages and disadvantages of fumigants Explain factors for success and failure for fumigation	Multimedia White board Computer Projector Internet Flipcharts Maker Textbooks	Identify fumigation process Identify the types of fumigants Identify factors for success and failure for fumigation Know causes of loses in crop storage	Guide trainees to: Identify fumigation process Recognize the types of fumigants Identify factors for success and failure for fumigation	Storage facility Fumigants Knapsacks PPE

	4.6 Discuss causes of loses in crop storage 4.7 Describe essential storage activities before, during and after crop storage	Explain causes of loses in crop storage Explain essential storage activities before, during and after crop storage		Identify essential storage activities before, during and after crop storage	Identify causes of loses in crop storage Recognize essential storage activities before, during and after crop storage	

	ASSESSMENT CRITERIA			
	Coursework	Course Test 20%	Practical 30%	Other: Examination/Project 50%

<table>
<tr><td colspan="3">PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE</td></tr>
<tr><td>MODULE: MACHINERY MANAGEMENT</td><td>SUBJECT CODE: CAM 321</td><td>CONTACT HOURS:</td></tr>
<tr><td>YEAR: 3 TERM: 2</td><td rowspan="2">PRE: REQUISITE: CAM 222</td><td>THEORETICAL:</td></tr>
<tr><td></td><td>PRACTICAL:</td></tr>
<tr><td colspan="3">GOAL: This module is aimed at providing the trainee with knowledge and practical skills of selecting agricultural machinery and tractors.</td></tr>
<tr><td colspan="3">GENERAL OBJECTIVE: On completion of this module, the trainee should be able to:

1.0 Understand factors affecting tractor selection

2.0 Understand factors affecting selection of Implements

3.0 Know the principle of matching tractor- equipment

4.0 Understand management of selection and matching tractor- equipment</td></tr>
</table>

PROGRAMME: NTC AND ANTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE						
MODULE: MACHINERY MANAGEMENT			**COURSE CODE:** CAM 321		**CONTACT HOURS:**	
					THEORETICAL: HOURS	
YEAR: 3	**TERM:** 2		**PRE: REQUISITE:** CAM 222		**PRACTICAL:** HOURS	
GOAL: This module is aimed at providing the trainee with knowledge and practical skills of electing agricultural machinery and tractors.						
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
GENERAL OBJECTIVE 1.0: Understand factors affecting tractor selection						
WEEK	**SPECIFIC LEARNING OUTCOME**	**TEACHERS ACTIVITIES**	**RESOURCES**	**SPECIFIC LEARNING OBJECTIVES**	**TEACHERS ACTIVITIES**	**RESOURCES**
1-3	1.1 Define machine selection in the context of tractor machinery management. 1.2 Explain factors influencing tractor selection: • Horsepower • Implement compatibility • Terrain 1.3 Discuss types of tractors and their applications: • Utility • Row-crop • Orchard 1.4 Discuss tools and resources for evaluating tractor performance: • Manufacturer specs • Cost-benefit analysis 1.5 Discuss Tractor selection	Explain machine selection in the context of tractor machinery management. Explain factors influencing tractor selection: • Horsepower • Implement compatibility • Terrain Explain types of tractors and their applications: • Utility • Row-crop • Orchard Explain tools and resources for evaluating tractor performance: • Manufacturer specs • Cost-benefit	Charts White Board Computer Internet Slides Drawings Projector Markers Multimedia	Know key factors influencing tractor selection Identify tractor types and their applications based on utility, row-crop, orchard)	Guide trainees to: Identify key factors influencing tractor selection Recognize tractor types and their applications based on utility, row-crop, orchard	Tractor implements Data sheets from tractor manufacturers. Data sheets from implement manufacturers Cost calculators Sheets for fuel, maintenance, and ownership costs.

	for given field data: • Yield • Size of speed etc.	analysis Explain Tractor selection for given field data: • Yield • Size of speed etc.		Identify tractor from standard chart based on given field data	Select tractor from standard chart based on given field data	
GENERAL OBJECTIVE 2.0: Understand factors affecting selection of Implements						
4-6	2.1 Discuss types of implements: • Trailed • Mounted • Semi mounted 2.2 Discuss factor considered in selecting implements/machinery: • Machine performance • Total machine cost including ownership cost, labour cost, operation cost, etc. 2.3 Describe factors affecting determination of machine size: • Field size • Labour supply • Tillage practices, etc.	Explain types of implements (e.g., Trailed, mounted and semi mounted) Explain factor considered in selecting implements/machinery • Machine performance • Total machine cost including ownership cost, labour cost, operation cost, etc. Explain factors affecting determination of machine size: • Field size • Labour supply • Tillage practices, etc.	Charts White Board Computer Internet Slides Drawings Projector Markers Multimedia	Compare different types of implements and their applications. Match tractors to implements based on power, size, and functionality. Use tools and resources to evaluate tractor-implement compatibility and performance.	Guide trainees to: Compare different types of implements and their applications. Match tractors to implements based on power, size, and functionality. Use tools and resources to evaluate tractor-implement compatibility and performance.	Tractor implements Charts

	2.4 Explain the importance of operational costs in machine selection: • Fuel efficiency • Maintenance • Resale value	Explain the importance of operational costs in machine selection: • Fuel efficiency • Maintenance • Resale value				
GENERAL OBJECTIVE 3.0: Know the principle of matching tractor- equipment						
7 - 9	3.1 Explain the process of matching tractors to implements: • Plows • Harvesters • Loaders. 3.2 Explain selection of a tractor and implement for a specific farming operation 3.3 Discuss the role of technology in modern tractor-implement systems: • GPS • Precision farming	Explain the process of matching tractors to implements: • Plows • Harvesters • Loaders. Explain selection of a tractor and implement for a specific farming operation Explain the role of technology in modern tractor-implement systems: • GPS • Precision farming	Charts White Board Computer Internet Slides Drawings Projector Markers	Analyze operational efficiency in tractor-implement pairing Identify a tractor-implement combination for a specific farming operation based on given criteria	Guide trainees to: Analyze operational efficiency in tractor-implement pairing Select a tractor-implement combination for a specific farming operation based on given criteria.	Tractor implements GPS

GENERAL OBJECTIVE 4.0: Understand management of selection and matching tractor- equipment						
10 - 12	4.1 Discuss financing options, government subsidies, and vendor incentives related to machinery procurement. 4.2 Explain vendor evaluation and negotiation strategies to secure favorable purchase and service agreements. 4.3 Discuss the formula for comprehensive machinery selection plan tailored to a specific farm's operational needs. 4.4 Describe steps to present a proposal justifying the selection decision based on	Explain financing options, government subsidies, and vendor incentives related to machinery procurement. Explain vendor evaluation and negotiation strategies to secure favorable purchase and service agreements. Explain formula for comprehensive machinery selection plan tailored to a specific farm's operational needs. Explain steps to present a proposal justifying the selection decision based on technical, economic, and sustainability factors.	Charts White Board Computer Internet Slides Drawings Projector Markers	Present a detailed selection proposal justifying the selection decision based on technical, economic, and sustainability factors. Develop vendor evaluation and negotiation strategies to secure favorable purchase and service agreements. Maintain accurate records of evaluations, analysis	Guide trainees to: Select a proposal based on technical, economic, and sustainability factors. Identify vendor evaluation and negotiation strategies to secure favorable purchase and service agreements. Apply accurate records of evaluations, analysis	Tractor implement Digital tools Logbook

	technical, economic, and sustainability factors.					
	ASSESSMENT CRITERIA					
	Coursework	Course Test 20%	Practical 20%	Other: Examination/Project 60%		

<table>
<tr><td colspan="3">PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE</td></tr>
<tr><td>MODULE: MAINTENANCE AND TROUBLESHOOTING OF TRACTORS</td><td>SUBJECT CODE: CAM 322</td><td>CONTACT HOURS:</td></tr>
<tr><td>YEAR: 3 TERM: 2</td><td rowspan="2">PRE: REQUISITE: CAM 221</td><td>THEORETICAL:</td></tr>
<tr><td colspan="2"></td><td>PRACTICAL:</td></tr>
<tr><td colspan="3">GOAL: This module is aimed at providing trainee with the knowledge and skills to maintain and troubleshoot tractors</td></tr>
<tr><td colspan="3">GENERAL OBJECTIVE: On completion of this module, the trainee should be able to:

1.0 Understand routine maintenance of tractors
2.0 Understand maintenance of common tractor problems
3.0 Know tools and equipment for tractor maintenance and troubleshooting operations
4.0 Know troubleshooting operations of tractors</td></tr>
</table>

PROGRAMME: NTC AND ANTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE						
MODULE: MAINTENANCE AND TROUBLESHOOTING OF TRACTORS			**COURSE CODE:** CAM 322		**CONTACT HOURS:**	
					THEORETICAL:	
YEAR: 3	**TERM:** 2		**PRE: REQUISITE:** CAM 221		**PRACTICAL:**	
GOAL: This module is aimed at providing trainee with the knowledge and skills to maintain and troubleshoot tractors						
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
GENERAL OBJECTIVE 1.0: Understand routine maintenance of tractors						
WEEK	**SPECIFIC LEARNING OUTCOME**	**TEACHERS ACTIVITIES**	**RESOURCES**	**SPECIFIC LEARNING OBJECTIVES**	**TEACHERS ACTIVITIES**	**RESOURCES**
1-3	1.1 Define routine maintenance 1.2 Discuss routine maintenance: • Checking fluid levels • Greasing fittings • Replacing filters 1.3 Discuss the importance of maintenance in tractor performance and longevity 1.4 Explain the key components of a tractor that require regular maintenance: • Engine • Transmission	Explain routine maintenance Explain routine maintenance: • Checking fluid levels • Greasing fittings • Replacing filters Explain the importance of maintenance in tractor performance and longevity Explain the key components of a tractor that require regular maintenance:	Charts Whiteboard Computer Internet Slides Drawings Projector Markers Multimedia	Identify routine maintenance Identify key components of a tractor that require regular maintenance. Follow maintenance schedules and perform routine tasks: • Oil changes • Filter replacements	Guide trainees to: Identify routine maintenance Identify key components of a tractor that require regular maintenance. Follow maintenance schedules and perform routine tasks: • Oil changes • Filter replacements	Tractor models Maintenance tools (e.g., wrenches, grease guns, oil filter removers). Diagnostic equipment (e.g., multimeters, pressure gauges, OBD scanners). Replacement parts (e.g., filters, belts, fluids). Safety gear (e.g., gloves, goggles, protective clothing).

	• Hydraulics • Cooling system 1.5 Discuss maintenance schedules for tractors: • Daily • Weekly • Seasonal	• Engine • Transmission • Hydraulics • Cooling system Explain maintenance schedules for tractors: • Daily • Weekly • Seasonal				
GENERAL OBJECTIVE 2.0: Understand maintenance of common tractor problems						
4-6	2.1 Explain common tractor problems: • Engine overheating • Hydraulic leaks • Electrical issues 2.2 Discuss the causes of tractor problems 2.3 Explain the process of performing routine maintenance tasks • Oil changes • Filter replacements • Lubrication	Explain common tractor problems: • Engine overheating • Hydraulic leaks • Electrical issues Explain the causes of tractor problems Explain the process of performing routine maintenance tasks • Oil changes • Filter replacements • Lubrication	Charts White Board Computer Internet Slides Drawings Projector Markers Multimedia	Diagnose common tractor problems Identify problems in a given tractor Perform routine maintenance a tractor to address common issues.	Guide trainees to: Diagnose common tractor problems Identify problems in a given tractor Perform routine maintenance a tractor to address common issues.	Tractor Lubricants Grease oil
GENERAL OBJECTIVE 3.0: Know tools and equipment for tractor maintenance and troubleshooting operations						
7-9	3.1 Explain tools and equipment for tractor	Explain tools and equipment for tractor	Charts White Board Computer	Identify tools and equipment for tractor	Guide trainees to: Select tools and equipment for	Tractor maintenance manuals

	maintenance and troubleshooting. 3.2 Discuss troubleshooting operation on a tractor 3.3 Describe maintenance of the troubleshooting result in 3.3	maintenance and troubleshooting. Explain troubleshooting operation on a tractor Explain maintenance of the troubleshooting result in 3.3	Internet Slides Drawings Projector Markers Manual National Standards	maintenance and troubleshooting Carryout troubleshooting operation on a tractor Carry out maintenance activities	tractor maintenance and troubleshooting Conduct troubleshooting operation on a tractor Conduct maintenance activities	Manufacturer technical bulletins, and schematics. National safety standards and guidelines for tractor maintenance. Digital diagnostic tools Templates for maintenance checklists Electronic logbooks Repair documentation.
GENERAL OBJECTIVE 4.0: Know troubleshooting operations of tractors						
10- 12	4.1 Discuss troubleshooting techniques use for diagnosing : • Visual inspections • Diagnostic tools • Systematic testing 4.2 Describe common engine problems using systematic troubleshooting methods.	Explain troubleshooting techniques for use diagnosing : • Visual inspections • Diagnostic tools • Systematic testing Explain common engine problems using systematic	Charts White Board Computer Internet Slides Drawings Projector Markers	Identify trouble shooting techniques	Guide trainees to: Identify trouble shooting techniques Conduct diagnoses of common engine problems using systematic	Tractor maintenance manuals Manufacturer technical bulletins, and schematics. National safety standards and guidelines for

	• Misfires • Overheating • Oil leaks 4.3 Discuss diagnostic tools to identify electrical and electronic issues: • Multimeters • Scan tools • Thermal cameras 4.4 Discuss how to troubleshoot hydraulic system issues: • Pressure drops • Leaks. 4.5 Describe the condition of cooling systems, identifying problems like: • Blocked radiators • Faulty fans • Thermostat failures. 4.6 Discuss issues in the fuel system: • Clogged filters • Injector malfunctions. 4.7 Discuss transmission and drivetrain performance to detect abnormal	troubleshooting methods. • Misfires • Overheating • Oil leaks Explain diagnostic tools to identify electrical and electronic issues: • Multimeters • Scan tools • Thermal cameras Explain how to troubleshoot hydraulic system issues: • Pressure drops • Leaks. Explain the condition of cooling systems, identifying problems like: • Blocked radiators • Faulty fans • Thermostat failures. Explain issues in the fuel system: • Clogged filters • Injector malfunctions.		Diagnose common engine problems using systematic troubleshooting methods Use electronics diagnostic tools Identify faults in hydraulic system pressure drops and leakages Carry out troubleshooting activity on cooling system Carry out troubleshooting activity on fuel system	troubleshooting methods Use electronics diagnostic tools Carry out troubleshooting activity on hydraulic system Conduct troubleshooting activity on cooling system Conduct troubleshooting activity on fuel system	tractor maintenance. Digital diagnostic tools Templates for maintenance checklists Electronic logbooks Repair documentation

	vibrations and gear slippage. 4.8 Discuss conditions for tire and wheel: • Alignment • Balancing • Wear patterns.	Explain transmission and drivetrain performance to detect abnormal vibrations and gear slippage Explain conditions for tire and wheel: • Alignment • Balancing • Wear patterns.		Assess transmission and drivetrain performance to detect abnormal vibrations and gear slippage. Analyze tire and wheel conditions for proper alignment, balancing, and wear patterns.	Inspect the transmission and drivetrain to detect abnormal vibrations and gear slippage. Analyze tire and wheel conditions for proper alignment, balancing, and wear patterns.	
	Coursework	Course Test 20%	Practical 40%	Other: Examination/Project 40%		

<table>
<tr><td colspan="3">PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE</td></tr>
<tr><td>MODULE: WHEELS AND TIRES</td><td>SUBJECT CODE: CAM 323</td><td>CONTACT HOURS:</td></tr>
<tr><td>YEAR: 3 TERM: 2</td><td rowspan="2">PRE: REQUISITE:</td><td>THEORETICAL:</td></tr>
<tr><td></td><td>PRACTICAL:</td></tr>
<tr><td colspan="3">GOAL: This module is aimed at providing the trainee with knowledge and practical skills for inspecting, maintaining, diagnosing, and repairing tractor wheels and tires</td></tr>
<tr><td colspan="3">GENERAL OBJECTIVE: On completion of this module, the trainee should be able to:

1.0 Understand Wheels and Tires in Tractors and implements
2.0 Understand Tire threads and tire aids in tractor wheels and tires
3.0 Know wheel alignment of tractor tires
4.0 Understand Tractor tire aids -tractor chain</td></tr>
</table>

PROGRAMME: NTC AND ANTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE						
MODULE: WHEELS AND TIRES			**COURSE CODE:** CAM 323		**CONTACT HOURS:**	
					THEORETICAL:	
YEAR: 3	**TERM:** 2		**PRE: REQUISITE: 131**		**PRACTICAL:** Hours	
GOAL: This module is aimed at providing the trainee with knowledge and practical skills for inspecting, maintaining, diagnosing, and repairing tractor wheels and tires						
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
GENERAL OBJECTIVE 1.0: Understand Wheels and Tires in Tractors and implements						
WEEK	**SPECIFIC LEARNING OUTCOME**	**TEACHERS ACTIVITIES**	**RESOURCES**	**SPECIFIC LEARNING OBJECTIVES**	**TEACHERS ACTIVITIES**	**RESOURCES**
1-3	1.1 Define the role of wheels and tires in: • Tractor performance • Stability • Traction. 1.2 Describe the construction of tractor tires: • Casing • Tread • Sidewall 1.3 Discuss different types of tractor tires and their applications: • Radial • Bias-ply	Explain the role of wheels and tires in: • Tractor performance • Stability • Traction Explain the construction of tractor tires: • Casing • Tread • Sidewall Explain different types of tractor and their applications: • Radial • Bias-ply • Flotation.	Charts White Board Computer Internet Slides Drawings Projector Markers Multimedia	Identify the components of a tractor tire Compare radial, bias-ply, and flotation tires and their applications.	Guide trainees to: Identify the components of a tractor tire Identify radial, bias-ply, and flotation tires and their applications.	Sample tires (radial, bias-ply, flotation) for comparison. Maintenance tools (e.g., pressure gauges, tread depth gauges, tire inflators). Repair kits (e.g., puncture repair tools, bead breakers). Ballasting equipment (e.g., liquid ballast pumps, wheel weights). Tire chains for traction improvement.

	• Flotation. 1.4 Discuss the factors influencing tire selection: • Soil type • Load capacity • Traction requirements. 1.5 Describe the importance of tire pressure and its impact on performance and wear. 1.6 Explain the process of checking and adjusting tire pressure	Explain the factors influencing tire selection: • Soil type • Load capacity • Traction requirements. Explain the importance of tire pressure and its impact on performance and wear. Explain the process of checking and adjusting tire pressure		Identify appropriate tires based on soil type, load capacity, and traction requirements. Identify tire pressure and its impact on performance. Carryout checking and adjusting tire pressure	Select appropriate tires based on soil type, load capacity, and traction requirements. Inspect tire pressure and its impact on performance. Demonstrate the process of checking and adjusting tire pressure	Safety gear (e.g., gloves, goggles, protective clothing).

GENERAL OBJECTIVE 2.0: Understand Tire threads and tire aids in tractor wheels and tires						
4-6	2.1 Describe the function of tire tread patterns and their suitability for different terrains. 2.2 Describe the concept of tire ballasting and its role in improving	Explain the function of tire tread patterns and their suitability for different terrains. Explain the concept of tire ballasting and its role in improving	Charts White Board Computer Internet Slides Drawings Projector Markers Multimedia	Identify the function of tread patterns and their suitability for different terrains. Identify ballasting and its role in improving traction.	Guide trainees to: Identify the function of tread patterns and their suitability for different terrains.	Tractor Tires Liquid ballast Weights

	traction and stability. 2.3 Discuss the process of adding ballast to tractor tires: • Liquid ballast • Weights 2.4 Discuss common tire problems and their causes: • Punctures • Uneven wear • Sidewall damage 2.5 Discuss troubleshooting techniques for diagnosing and resolving tire issues. 2.6 Describe the importance of tire rotation and its impact on wear patterns. 2.7 Explain the process of rotating tractor tires.	traction and stability. Explain the process of adding ballast to tractor tires: • Liquid ballast • Weights Explain common tire problems and their causes: • Punctures • Uneven wear • Sidewall damage Explain troubleshooting techniques for diagnosing and resolving tire issues. Explain the importance of tire rotation and its impact on wear patterns. Explain the process of rotating tractor tires.		Identify common tire issues Check tire issues using systematic troubleshooting. Know tire rotation and its impact on wear patterns. Demonstrate the process of adding ballast to tractor tires	Recognize ballasting and its role in improving traction. Recognize common tire issues Diagnose and resolve tire issues using systematic troubleshooting. Identify tire rotation and its impact on wear patterns.	

					Demonstrate the process of adding ballast to tractor tires	

GENERAL OBJECTIVE 3.0: Know wheel alignment of tractor tires						
7 - 9	3.1 Discuss the impact of improper tire maintenance on fuel efficiency and operational costs. 3.2 Explain the process of checking and adjusting wheel alignment. 3.3 Describe the role of wheel alignment in tire performance and longevity.	Explain the impact of improper tire maintenance on fuel efficiency and operational costs. Explain the process of checking and adjusting wheel alignment. Explain the role of wheel alignment in tire performance and longevity	Charts White Board Computer Internet Slides Drawings Projector Markers Multimedia	Identify the role of wheel alignment in tire performance. Identify the impact of improper tire maintenance on fuel efficiency and costs.	Guide trainees to: Identify the role of wheel alignment in tire performance. Identify the impact of improper tire maintenance on fuel efficiency and costs.	Tire Wheels PPE

GENERAL OBJECTIVE 4.0: Understand Tractor tire aids -tractor chain						
10 - 12	4.1 Explain the use of tire chains for improved traction in challenging conditions. 4.2 Discuss the installation and removal of tire chains	Explain the use of tire chains for improved traction in challenging conditions. Explain the installation and removal of tire chains	Charts White Board Computer Internet Slides Drawings Projector Markers Multimedia	Identify tire chains for improved traction in challenging conditions. Carryout installation and removal of tire chains	Guide trainees to: Identify tire chains for improved traction in challenging conditions. Demonstrate the installation and removal of tire chains Follow safety protocols when working with	Tire chain PPE

	4.3 Describe the safety precautions for working with tractor wheels and tires. 4.4 Discuss inspection steps of tractor wheels and tires	Explain the safety precautions for working with tractor wheels and tires. Explain inspection steps of tractor wheels and tires		Observe safety protocols when working with tractor wheels and tires. Perform a detailed inspection of tractor wheels and tires	tractor wheels and tires. Conduct a detailed inspection of tractor wheels and tires,	
	ASSESSMENT CRITERIA					
	Coursework	Course Test 20%	Practical 40%	Other: Examination/Project 40%		

<table>
<tr><td colspan="3">PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE</td></tr>
<tr><td>MODULE: MAINTENANCE OF PRECISION AGRICULTURAL EQUIPMENT AND MACHINES</td><td>SUBJECT CODE: CAM 331</td><td>CONTACT HOURS:</td></tr>
<tr><td>YEAR: 3 TERM: 3</td><td rowspan="2">PRE: REQUISITE:</td><td>THEORETICAL:</td></tr>
<tr><td></td><td>PRACTICAL:</td></tr>
<tr><td colspan="3">GOAL: This module is aimed at providing trainee with knowledge and practical skills necessary to maintain, troubleshoot, and calibrate precision agricultural equipment</td></tr>
<tr><td colspan="3">GENERAL OBJECTIVE: On completion of this module, the trainee should be able to:

1.0 Know precision equipment system inspection and diagnostics
2.0 Understand Calibration, Adjustment of precision equipment components and Software Maintenance
3.0 Understand Environmental and Safety Considerations of precision equipment maintenance
4.0 Understand Data Integration, Record keeping and reporting of maintenance of precision equipment</td></tr>
</table>

PROGRAMME: NTC AND ANTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE						
MODULE MAINTENANCE OF PRECISION AGRICULTURAL EQUIPMENT AND MACHINES				**COURSE CODE:** CAM 331		**CONTACT HOURS:** **THEORETICAL:**
YEAR: 3 **YEAR:** 3				**PRE: REQUISITE:**		**PRACTICAL:**
GOAL: This module is aimed at providing trainee with knowledge and practical skills necessary to maintain, troubleshoot, and calibrate precision agricultural equipment						
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
GENERAL OBJECTIVE 1.0: Know precision equipment system inspection and diagnostics						
WEEK	**SPECIFIC LEARNING OUTCOME**	**TEACHERS ACTIVITIES**	**RESOURCES**	**SPECIFIC LEARNING OBJECTIVES**	**TEACHERS ACTIVITIES**	**RESOURCES**
1-3	1.1 Explain the role and importance of precision agriculture in modern farming. 1.2 Discuss various types of precision agricultural equipment: • GPS guidance systems • Auto-steer tractors • Variable rate application equipment • Sensor arrays • Drones 1.3 Explain the integration of hardware and software components in precision equipment.	Explain the role and importance of precision agriculture in modern farming. Explain various types of precision agricultural equipment: • GPS guidance systems • Auto-steer tractors • Variable rate application equipment • Sensor arrays • Drones Explain the integration of hardware and software components in precision equipment.	Charts White Board Slides Drawings Projector Computer Internet Markers Multimedia Digital schematics System flowcharts	Know the operational principles behind GPS guidance, sensor integration, and variable rate application systems. Identify how precision equipment integrates hardware and software to achieve field accuracy.	Guide trainees to: Recognize the operational principles behind GPS guidance, sensor integration, and variable rate application systems. Identify how precision equipment integrates hardware and software to achieve field accuracy.	Diagnostic and calibration software tools Manufacturer technical manuals Digital schematics Digital diagnostic and calibration tools Templates for electronic logbooks Maintenance checklists Calibration records

	1.4 Describe how to interpret technical manuals, manufacturer guidelines, and digital schematics for precision systems.	Explain how to interpret technical manuals, manufacturer guidelines, and digital schematics for precision systems.		Carryout comprehensive visual and digital inspections of precision ag systems. Use diagnostic tools to assess sensor health and connectivity.	Conduct comprehensive visual and digital inspections of precision ag systems. Use diagnostic tools to assess sensor health and connectivity.	

GENERAL OBJECTIVE 2.0: Understand Calibration, Adjustment of precision equipment components and Software Maintenance						
4-6	2.1 Explain routine inspections and preventive maintenance on electronic and mechanical components. 2.2 Explain calibration of GPS, RTK (Real-Time Kinematic) systems, and other sensors to ensure high positional accuracy. 2.3 Explain communication and connectivity issues between equipment components (e.g.,	Explain routine inspections and preventive maintenance on electronic and mechanical components. Explain calibration of GPS, RTK (Real-Time Kinematic) systems, and other sensors to ensure high positional accuracy.	Charts White Board Slides Drawings Projector Computer Internet Markers Multimedia Digital schematics System flowcharts	Apply precise calibrations of GPS and RTK systems to ensure optimal accuracy.	Guide trainees to: Perform precise calibrations of GPS and RTK systems to ensure optimal accuracy.	Diagnostic and calibration software tools Manufacturer technical manuals Digital schematics Digital diagnostic and calibration tools Templates for electronic logbooks Maintenance checklists

	between control units and field sensors). 2.4 Explain troubleshooting of software-related issues, including firmware updates, data logging errors, and system integration problems 2.5 Discuss the performance of precision systems using diagnostic tools and digital monitoring software	Explain the performance of precision systems using diagnostic tools and digital monitoring software		Identify sensor arrays and control units using manufacturer-specified procedures. Update firmware and perform software diagnostics on integrated precision systems. Carryout troubleshooting of data logging errors and system integration issues	Adjust sensor arrays and control units using manufacturer-specified procedures. Update firmware and perform software diagnostics on integrated precision systems. Conduct troubleshoot of data logging errors and system integration issues	Calibration records

GENERAL OBJECTIVE 3.0: Understand Environmental and Safety Considerations of precision equipment maintenance						
7 - 9	3.1 Explain the environmental factors that affect the performance of precision equipment: • Signal interference • Weather conditions	Explain the environmental factors that affect the performance of precision equipment: • Signal interference	Charts White Board Slides Drawings Projector Computer Internet	Assess environmental factors that affect equipment performance and recommend protective measures.	Guide trainees to: Assess environmental factors that affect equipment performance and	Software

	3.2 Discuss analysis of sensor data to determine the health and performance of variable rate application systems. 3.3 Describe cleaning and protection procedures to safeguard sensitive electronic components from dust, moisture, and field debris. 3.4 Explain maintenance procedures and repair histories in standardized electronic logbooks. 3.5 Explain safety protocols and use appropriate personal protective equipment (PPE) when working with high-voltage or sensitive electronic systems. 3.6 Explain software diagnostics using simulation tools and	• Weather conditions Explain analysis of sensor data to determine the health and performance of variable rate application systems. Explain cleaning and protection procedures to safeguard sensitive electronic components from dust, moisture, and field debris. Explain maintenance procedures and repair histories in standardized electronic logbooks. Explain safety protocols and use appropriate personal protective equipment (PPE) when working with high-voltage or sensitive electronic systems. Explain software diagnostics using simulation tools and	Markers Multimedia Digital schematics System flowcharts	Follow strict safety protocols when handling sensitive electronics and high-voltage components. Update firmware and perform software diagnostics on integrated precision systems.	recommend protective measures. Apply strict safety protocols when handling sensitive electronics and high-voltage components. Perform software diagnostics on integrated precision systems.	

	digital troubleshooting aids.	digital troubleshooting aids.		Inspect data logging errors and system integration issues using simulation tools.	Troubleshoot data logging errors and system integration issues using simulation tools.	

GENERAL OBJECTIVE 4.0: Understand Data Integration, Record keeping and Reporting of maintenance of precision equipment						
10 - 12	4.1 Explain a preventive maintenance schedule tailored to the operational demands and environmental conditions of precision equipment. 4.2 Explain how to collaborate with technical support teams and vendors for complex system issues or updates. 4.4 Describe how to integrate data from precision equipment into farm management software for continuous performance monitoring	Explain a preventive maintenance schedule tailored to the operational demands and environmental conditions of precision equipment. Explain how to collaborate with technical support teams and vendors for complex system issues or updates. Explain how to integrate data from precision equipment into farm management software for continuous	Charts White Board Slides Drawings Projector Computer Internet Markers Multimedia Digital schematics System flowcharts	Develop and implement a preventive maintenance schedule based on equipment usage and environmental conditions. Know calibration settings, repair actions, and system performance in an electronic logbook. Integrate sensor data into farm management software and analyze trends for maintenance planning.	Guide trainees to: Develop and implement a preventive maintenance schedule based on equipment usage and environmental conditions. Document calibration settings, repair actions, and system performance in an electronic logbook. Integrate sensor data into farm management software and analyze trends for maintenance planning. Carry out detailed technical reports and	Software

	4.4 Describe maintenance strategies to new technologies and emerging trends in precision agriculture. 4.5 Describe how to present technical findings and maintenance reports to stakeholders with clear, data-driven recommendations.	Explain maintenance strategies to new technologies and emerging trends in precision agriculture. Explain how to present technical findings and maintenance reports to stakeholders with clear, data-driven recommendations.		Prepare detailed technical reports and present data-driven recommendations to stakeholders.	present data-driven recommendations to stakeholders.	
	ASSESSMENT CRITERIA					
	Coursework	Course Test 20%	Practical 40%	Other: Examination/Project 40%		

<table>
<tr><td colspan="3">PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE</td></tr>
<tr><td>MODULE: TRACTORS AND THEIR POWER UNIT</td><td>SUBJECT CODE: CAM 332</td><td>CONTACT HOURS:</td></tr>
<tr><td>YEAR: 3 TERM: 3</td><td rowspan="2">PRE: REQUISITE:</td><td>THEORETICAL:</td></tr>
<tr><td></td><td>PRACTICAL:</td></tr>
<tr><td colspan="3">GOAL: This module is designed to provide the trainee with relevant knowledge of the components of a power unit (engine components, fuel, cooling, and lubricating systems).</td></tr>
<tr><td colspan="3">GENERAL OBJECTIVE: On completion of this module, the trainee should be able to:

1.0 Understand the working principles of an internal combustion engine.

2.0 Understand the general layout and working principles of fuel systems.

3.0 Understand the basic diesel fuel injection system.

4.0 Understand the basic working principles of cooling system

5.0 Understand lubrication system</td></tr>
</table>

PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE						
MODULE: TRACTORS AND THEIR POWER UNIT			**COURSE CODE:** CAM 332		**Contact HOURS:** 180	
					THEORETICAL:	
YEAR: 3	**TERM:** 3		**PRE: REQUISITE:**		**PRACTICAL:**	
GOAL: This module is designed to provide the trainee with relevant knowledge of the components of a power unit (engine components, fuel, cooling, and lubricating systems).						
THEORETICAL CONTENT				**PRACTICAL CONTENT**		
GENERAL OBJECTIVE 1.0: Understand the working principles of an internal combustion engine.						
WEEK	**SPECIFIC LEARNING OUTCOME**	**TEACHERS ACTIVITIES**	**RESOURCES**	**SPECIFIC LEARNING OBJECTIVES**	**TEACHERS ACTIVITIES**	**RESOURCES**
1-2	1.1 Define internal combustion 1.2 Describe the layout of an internal combustion engine 1.3 Define the following terms: • Two Stroke cycle Engine • Four Stroke cycle Engine 1.4 Describe the working principle of two strokes cycle engine	Explain internal combustion Explain the layout of an internal combustion engine Explain the following terms • Two Stroke cycle Engine • Four Stroke cycle Engine Explain the working principle of two strokes cycle engine Explain the working principle of four Stroke cycle engine	White Board Multimedia Textbooks Diagrams Charts Computer Internet Markers	Identify internal combustion Identify the layout of an internal combustion engine Identify the following: • Two Stroke cycle Engine • Four Stroke cycle Engine Identify the working principle of two strokes cycle engine.	Guide trainees to: Identify internal combustion Draw the layout of an internal combustion engine Recognize the following: • Two Stroke cycle Engine • Four Stroke cycle Engine Recognize the working principle of two strokes cycle engine.	Tools box Complete Engine model Work table

	1.5 Describe the working principle of four Stroke cycle engine 1.6 Differentiate between two stroke cycle engine and four stroke cycle engine 1.7 Describe the following: • Compression ignition • Compression ratio • Compression pressure. 1.8 Describe measurements and compression reading relative to Power Unit.	Explain between two stroke cycle engine and four stroke cycle engine Explain the following • Compression ignition • Compression ratio • Compression pressure Explain measurements and compression reading relative to Power Unit.		Identify the working principle of four Stroke cycle engine Know the difference between two stroke cycle engine and four stroke cycle engine Identify the following: • Compression ignition • Compression ratio • Compression pressure Interpret measurements and compression reading relative to Power Unit.	Recognize the working principle of four Stroke cycle engine Differentiate between two stroke cycle engine and four stroke cycle engine Identify the following: • Compression ignition • Compression ratio • Compression pressure . Recognize measurements and compression reading relative to Power Unit.	

GENERAL OBJECTIVE 2.0: Understand the general layout and working principles of fuel system.						
3-4	2.1 Define diesel fuel components: • Fuel pump • Fuel tank • Fuel lures • Fuel filter	Explain diesel fuel components: • Fuel pump • Fuel tank • Fuel lures • Fuel filter	White Board Multimedia Textbooks Diagrams Charts Computer		Guide trainees to:	Tools box Complete Engine model Work table

	• Fuel injector • Nozzles etc. 2.2 Describe the various components of fuel system 2.3 Describe difference between petrol and diesel fuel system 2.4 Describe the working principle of the fuel lift pump, in line and distributor injection pump, filters injectors, governors and cold starting.	• Fuel injector • Nozzles etc. Explain the various components of fuel system Explain the difference between petrol and diesel fuel system Explain the working principle of the fuel lift pump, in line and distributor injection, pump, filters injectors, governors and cold starting.	Internet Markers	Identify diesel fuel components: • Fuel pump • Fuel tank • Fuel lures • Fuel filter • Fuel injector • Nozzles etc. Identify the various components of fuel system Differentiate between petrol and diesel fuel system Know the working principle of the fuel lift pump, in line and distributor injection, pump, filters injectors, governors and cold starting	Recognize diesel fuel components: • Fuel pump • Fuel tank • Fuel lures • Fuel filter • Fuel injector • Nozzles etc. Recognize the various components of fuel system Differentiate between petrol and diesel fuel system Identify the working principle of the fuel lift pump, in line and distributor injection, pump, filters injectors,	

GENERAL OBJECTIVE 3.0**:** Understand the basic diesel fuel injection system.						
7-8	3.1 Define the principle of injection	Explain the principle of injection	White Board Multimedia Textbooks			Engine model

	3.2 Describe the principle of injection in diesel Engines 3.3 Describe the different types of injection pumps 3.4 Describe the working principle of different types of injection pumps	Explain the principle of injection in diesel engines Explain the different types of injection pumps Explain the working principle of different types of injection pumps	Diagrams Charts Computer Internet Markers	Identify the injection Identify injector in diesel engines Identify the different types of injection pumps Identify the working principle of different types of injection pumps	Guide trainees to: Identify the injection Recognize injector in diesel engines Identify the different types of injection pumps Recognize the working principle of different types of injection pumps	Tools Worktable

GENERAL OBJECTIVE 4 .0: Understand the basic working principles of cooling system						
9-10	4.1 Define the cooling system of a tractor 4.2 Describe the working principles of tractor cooling system 4.3 Describe radiator and its components 4.4 Describe the functions of pressure cap 4.5 Describe main faults of cooling system parts: • Radiator • Fan & Fan belts • Water pump • Thermostat	Explain the cooling system of a tractor Explain the working principles of tractor cooling system Explain radiator and its components Explain the functions of pressure cap Explain main faults of cooling system parts • Radiator • Fan & Fan belts • Water pump • Thermostat	White Board Multimedia Textbooks Diagrams Charts Computer Internet Markers	Identify the cooling system of a tractor Know the working principles of tractor cooling system Identify radiator and its components Know the functions of pressure cap Identify main faults of cooling system parts • Radiator	Guide trainees to: Identify the cooling system of a tractor Recognize the working principles of tractor cooling system Recognize radiator and its components Know the functions of pressure cap Recognize main faults of cooling system parts • Radiator	Thermostat Liquid Flush Soldering iron Lead

				• Fan & Fan belts • Water pump • Thermostat	• Fan & Fan belts • Water pump • Thermostat	

GENERAL OBJECTIVE 5 .0**:** Understand lubrication system						
11-12	5.1 Define the lubrication system of a tractor 5.2 Describe different types of lubricating systems: • Splash • Pump • Squash and mix 5.3 Define the terms: lubricating oil and filters 5.4 Describe the different types of lubrication oil filters usable and disposable 5.5 Describe the effects of oil thickening on lubrication 5.6 State the various types of oil and their viscosities	Explain the lubrication system of a tractor Explain different types of lubricating systems: • Splash • Pump • Squash and mix Explain the terms lubricating oil and filters Explain the different types of lubricating oil filters usable and disposable Explain the effects of oil thickening on lubrication Explain the various types of oil and their viscosities	White Board Multimedia Textbooks Diagrams Charts Computer Internet Markers	Identify the lubrication system of a tractor Identify different types of lubricating systems Identify lubricating oil and filters Identify the effects of oil thickening on lubrication Identify the various types of oil and their viscosities	Guide trainees to: Recognize the lubrication system of a tractor Recognize different types of lubricating systems Identify lubricating oil and filters Recognize the effects of oil thickening on lubrication Recognize the various types of oil and their viscosities Recognize the factors affecting oil deterioration	Oil pump Oil filter Lubricants

	5.7 State the factors affecting oil deterioration – long usage contaminants, etc.	Explain the factors affecting oil deterioration – long usage contaminants, etc.		Identify the factors affecting oil deterioration		
	ASSESSMENT CRITERIA					
	Coursework	Course Test 20%	Practical 40%	Other: Examination/Project 40%		

PRACTICAL MANUAL AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANICS

HEALTH, SAFETY AND ENVIRONMENT CAM 111	Identify safety equipment and wears essential in the workplace/environment Demonstrate how to use safety equipment and wears essential in the workplace/environment Demonstrate safe ways of handling basic hand tools Show a film on industrial safety Identify types of hazards and how to prevent them. Identify potential hazards in a mock workplace Demonstrate safe handling of tools in workplace Demonstrate the procedures to be taken in the event of workplace accident Identify safe work procedure Demonstrate different methods of collecting, treating and disposing of waste in workplace Visit a storage/processing facilities Show video presentation of farm implements repairs/maintenance
USE OF WORKSHOP TOOLS AND EQUIPMENT CAM 112	Identify workshop hand tool and equipment. Identify how to select tools for a particular task Identify how to use appropriate hand tool and equipment Identify basic hand tool and their importance Identify power tools and their significance Identify special tools and how to use them Identify how to organize and store your workshop tools Identify storage solutions for tools • Tool cabinet • Wall mounted storage • Toolboxes and totes • Tool foam inserts Identify personal protective equipment Identify tools maintenance and care Identify Workshop safety guidelines Identify ways of keeping the workshop clean and tidy
BASIC AGRICULTURAL SCIENCE CAM 113	Identify the following: • Parent rock • Sub soil • Top soil.

	Identify types of weathering Identify mechanics of weathering Identify soil structure and consistency Identify the following: • Soil aggregates • Soil water • Soil air • Soil micro-organisms • Organic matter Identify the classes of soil (clay loam, silt and sandy soil) using soil samples. Identify the various types of agricultural implements Identify the effect of different types of soil on various types of agricultural implements and vice-versa. Identify the effect of organic matter on soil Identify the effect of soil moisture on ploughing Identify the soil pH scale Identify requirements for seed germination. Identify the essential soil nutrients (micro and macro nutrients). Identify the functions of the essential nutrients in the crop. Identify the processes of photosynthesis and respiration. Identify the functions of parts of a crop flower Identify fertilization and fruits formation. Visit poultry and secluded animal grazing farms. Identify various species of animals and poultry birds Identify various type of housing required for each of poultry birds and animals Identify the requirements of different poultry birds and animal houses Identify the uses of the equipment used for different poultry birds and animal houses.
GENERAL METAL WORK I CAM 121	Identify general physical properties of metals Identify basic properties of carbon steels, cast iron and alloy steel Carryout the cupola process Identify ferrous and non-ferrous metals Field trip to a steel manufacturing plant Identify common measuring tools Identify difference between “line” and “end” measurement Carryout the use of datum points, datum lines and datum faces in marking out.

	Identify steel rule, dividers, caliphers, scribers etc. Identify types of files Identify common files for metal work Perform filing operations Identify functions of a vice Identify various parts of bench vice Carry out bench vice clamping Perform holding work on the vice for filling and tapping operations Identify the following working tools: • Cold chisels (flat, cross, cut half round, diamond-point) • Centre punch and dot punch • Scrapers (flat, triangular, half round) • Power hack saw Identify various parts of a hack saw and their function. Identify the common types of hacksaw blades, their range of pitches and their applications. Identify the safety precautions to be observed when using a hand hacksaw Identify different types of drilling machines Draw the main features of bench or pillar drilling machine Draw and label: • Twist drill (taper shank, parallel shank) • Jobbers drill • Flat drill • Countersink drill • Counter bore drill • Combination centre drill. Identify the effects of following faults in a ground twist drill: • Too acute point angle • Too abtuse point • Unequal cutting edges • Insufficient lip clearance • Excessive lip clearance. Calculate spindle revolution or cutting speed for specified size of drill using the formulae:- $N = 1000S/\pi d$

	$S = \pi dN/1000$ Where S = cutting speed (m/min) N = revolutions/minute D = diameter of drill (mm) $\pi = 3.142$ Carry out reaming operation Identify thread forms and their applications Identify the functions of:- • Taps (taper tap, second tap, plug) • Tap wrench • Die and die stock. Identify tapping size or tapping drill and estimate its value in given situations Identify precautions taken during taping operations Identify types of rivets Draw a rivet and calculate the diameter of rivet and riveting allowance in a given situations using the formula: T = D – P Identify between nominal size, limits, tolerance and fits. Identify with calculations the amount of tolerance and types of fits in given situations. Identify the essential features of a centre lathe Identify the functions of centre lathe accessories Identify types of cutting fluids used for lathe turning. Identify safety precautions to be observed when working on the lathe Identify with sketch common machining tools Identify with sketches of tool angles (rake, clearance) Identify various tool shapes Identify with sketches the effects of wrong cutting tools setting Identify the cutting speed and feed with respect to lathe operation. Carry out turning operation to determine: • The rate of metal removal • Time required for carrying out specified turning operations Calculate the cutting speed and feed for given turning operation: • The rate of metal removal

	• Time required for carrying out specified turning operations
MATERIAL AND WORKSHOP PROCESSES CAM 122	Identify sources of hazards in the workshop Demonstrate first and applications in case of minor injuries, electric shocks and burns Demonstrate artificial respiration using dummy Identify the properties of all types of metals Identify the uses of all types of alloys. Identify the advantages and limitations of special steels and other alloys Identify the causes and effects of corrosion of metals and prevent it by applying protective measures Identify metals by sound test, appearance, spark test and any other quick test. Identify the various tools used and their maintenance. Identify the importance of care of measuring instruments Identify the care of: • Pullers • Hydraulic press • Different types of jacking and lifting equipment cranes • Hydraulic jack • Hoists and slings. Identify, use and take care of various types of sheet metals Identify use of sheet metal tools Identify sheet metals for: • Welding • Soldering • Riveting Construct simple items such as: • Guards • Trays Identify the different types of soldering iron. Identify the setting up of welding equipment. Identify the basic principle of oxyacetylene welding Identify the use of bronze welding for repair work and build worn parts. Identify the use of oxy-acetylene flame to cut metal. Identify the principle of arc welding voltage.

	Identify common welding of mild steel cast Identify the effect of inadequate penetrating slag inclusion when welding. Identify difference between AC and DC welding systems Identify the advantages and disadvantages of oxy-acetylene welding process on agricultural repairs. Identify the application of hard surfacing rod by oxy-acetylene arc process for filling worn part and surface. Identify forging tools
INTRODUCTION TO AGRICULTURAL MECHANIZATION CAM 123	Identify simple basic machine Identify simple machine to agricultural machines Identify properties and usefulness of each machine Identify primary and secondary tillage operations. Identify the factors to consider when choosing tillage practices Identify common tillage equipment Identify planting process Identify planting machine Identify planter classification Identify planter component parts Identify planter soil-engaging components Identify planter seed metering components Identify planter seed delivery components Identify principles and functions of farm management Identify common tools used in farm management Identify key principles in machine management Identify machine management phases and levels Identify common preventive maintenance checks for maintenance Demonstrate how to perform agricultural machineries maintenance safely. Plan maintenance tasks in advance Carryout machinery management using safety culture
INTRODUCTION TO TRACTOR CAM 131	Identify the different sources of farm power Identify the features of a tractor Identify classification of farm tractors base on size, power and application Identify general purpose of row crop and special tractor Identify farm tractor depending on: • Land holding • Cropping pattern • Soil condition

	• Climate condition • Repairing facilities • Running cost • Resale value etc. Identify a power tiller Identify components of power tiller its operation and power transmission Identify tractor main components Identify the tractor engine system Identify the tractor transmission system Identify hitching system of tractor drawn implements Identify the following: • Wheel base • Ground clearance • Track • Turning space • Cage wheel
GENERAL METAL WORK II CAM 132	Identify the structural behaviour of plain carbon steel as it is heated from room temperature to about 1000^{o}C Demonstrate hardening metal work. Carryout safety precautions relating to heat treatment processes Identify the main features and working principles of the black smith's forge. Identify the functions of common forging tools Select appropriate forging tools for forging operations given engineering components Demonstrate with appropriate forging tools how to produce some engineering components Identify basic principles and application of gas and metal arc welding. Identify safety precautions to be observed and apply them in given welding situations. Draw and label various tool shapes Identify the difference between various tool shapes
ALTERNATIVE ENERGY EQUIPMENT CAM 211	Identify PV system Identify PV modules and Array Identify the construction of PV system Identify components od PV system Identify defects in PV system Perform Cleaning operations on the PV array Demonstrate basic methods of maintenance

	Construct a PV system assemble Measure PV Voltage from Inverter Identify an Inverters Identify types of inverters Use diagnostics tool (Multimeter, oscilloscope thermal camera) to PV assembly Identify wind turbine Identify types of wing turbine Identify components of wind turbine Identify structural issues such as erosion, cracks, and delamination. Visit an existing wind turbine facility Perform minor routine inspections and repairs on component in line with national safety standards. Observe any structural defective components Identify solar thermal collectors Identify fluids used solar thermal collectors Perform inspections of solar thermal collectors to identify common issues in fluid distribution systems Identify issues such as scaling, leaks, and insulation failures. Repair common issues in fluid distribution systems. Carryout documentation of maintenance activities Identify types of batteries in Solar energy storage Identify BMS Conduct routine inspections of battery modules and BMS. Identify performance degradation and document maintenance activities. Perform corrective actions on defective battery systems under supervision
IMPLEMENTS AND MACHINES I CAM 212	Identify primary and secondary tillage implements Identify the various types of harrow and ploughs arrangement Identify the various types of harrow and plough arrangement. Identify the various parts of harrow and plough Remove and install worn out or damaged disc or blades on ploughs, harrows, rotovators and ridgers. Carry out workshop and field adjustment on primary and secondary tillage implements Identify different types of planting equipment Carryout operational adjustment, setting and checking of application rate. Carryout coupling and de-coupling of planting equipment to a tractor Check, repair damaged or replace worn out parts Identify different types fertilizer applicators and manure spreaders Carryout maintenance on both fertilizer applicators and manure spreaders Calibrate application rate for fertilizer applicators

	Operate fertilizer applicators and manure spreaders Identify damage/worn out parts on fertilizer applicators and manure spreaders. Dismantle, assemble, repair damaged or replace worn out parts Mount and dismount inter- row machinery on a tractor. Repair or replace worn out or damage parts. Carryout maintenance spraying and dusting equipment Carryout calibration of spraying and dusting equipment Operate spraying and dusting equipment Dismantle, assemble, replace or repair damaged or worn out parts
MACHINING OPERATIONS CAM 213	Identify tools and machines for metal shaping operations. Identify tools use in metal shaping operation Use machines to carry out metal shaping and cutting operation. Use hand tools to carry out cutting and shaping of metals. Carry out shaping on lathe and milling machines Operate of common hand tools Operate metal shaping machine Plan for a shaping operation. Operate the lathe and other shaping machines for a shaping job Carry out shaping operation with hand tools and machines Identify the essential features of a centre lathe Identify the working principles of the centre lathe Identify the functions of centre lathe accessories Identify types of cutting fluids use for lathe turning. Identify safety precautions to be observed when working on the lathe Draw and label common tools: • Butt-brazed tool • Tipped tool • Bit and holder. Draw and label tool angles (rake, clearance) Identify tool shapes and state their uses Identify with sketches the effects of wrong setting cutting tools Identify the cutting speed and feed with respect to lathe operation. Identify the cutting speed and feed for given a turning operation, the rate of metal removal and time required for carrying out specified turning operations

	Identify different types of drilling machines Identify the main features of bench or pillar drilling machine Draw the main features of bench or pillar drilling machine Identify: • Twist drill (taper shank, parallel shank) • Jobbers drill • Flat drill • Countersink drill • Counter bore drill • Combination centre drill. Draw and label: • Twist drill (taper shank, parallel shank) • Jobbers drill • Flat drill • Countersink drill • Counter bore drill • Combination centre drill. Identify the effects of following faults in a: • Ground twist drill • Point angle too acute • Point angle too abtuse etc. Calculate spindle revolution or cutting speed for a specified size of drill. Carry out repairs and maintenance of: • Hand tools • Machining tools • Shaping machines Carry out repairs and maintenance of lathe machine and other machines
TRACTOR AND ITS COMPONENTS CAM 221	Identify tractor layout and its key elements. Identify the interrelationship between various subsystems within a tractor. Compare legacy designs with current layout trends. Draw and label a diagram of a tractor with component names

	Identify the function of each primary subsystem. Illustrate how these subsystems are arranged in standard tractor layouts. Identify the typical engine and transmission configurations. Evaluate design choices that affect powertrain efficiency and maintenance access Identify hydraulic components and their positions within the tractor layout. Identify the routing and integration of hydraulic lines and reservoirs. Identify major electrical components and their locations. Identify methods to optimize electrical routing for safety and performance. Identify the layout of tracks, wheels, and suspension components. Assess the impact of design choices on vehicle stability and wear. Identify standard cab configurations and control placements. Identify and describe the purpose of each control Operate controls in a simulated environment. Interpret dashboard instruments Identify safety features and mandatory layout requirements. Develop strategies to modify layouts to comply with safety and regulatory standards Identify the steps for starting and stopping a tractor. Demonstrate safe start-up and shutdown procedures. Diagnose and resolve common starting problems. Practice starting and stopping a tractor. Demonstrate safe operation in a field setting. Perform basic maneuvers with precision Identify and avoid field hazards Attach agricultural machinery units to tractor Identify the following types of cabs: • Gurgle cab • Canopy rain protector • Sun protector etc. Remove cabs on tractor Mount cabs on tractor
IMPLEMENTS AND MACHINES II DAM 222	Identify types of crop harvesting equipment Operate dairy equipment Repair or replace worn out or damage parts. Carry out workshop and field adjustment on crop harvesting equipment Identify types of forage harvesting equipment

	Identify components of forage harvesting equipment Carry out operation of harvesting equipment Repair and adjust: • Knife assembly • Conveyor • Chutes • Shear plate • Reflectors • Gear box Repair or replace worn out or damage parts. Carry out workshop and field adjustment on forage harvesting equipment Identify the parts of: • Gearbox • Cutter bar • Knife Sharpen knife section, flail disc Remove and replace damage or worn parts Carry out routine maintenance and adjustment of mowers Draw a line diagram to show the various parts of the mower Carry out workshop and field adjustment on mower Identify the following parts: • Pick up mechanism • Knife and shear plates • Tying mechanism Remove and replace damage or worn parts Carry out routine maintenance and adjustment of balers Identify types of dairy equipment Carry out operation of dairy equipment Carry out repair or replacement of worn out or damage parts
TRACTOR AND ITS COMPONENTS II	Identify components of a tractor

CAM 231	Identify functions of each tractor components Identify tractor engine parts • Cylinder block • Pistons • Crankshaft Identify internal combustion Identify internal combustion engine Identify the layout of an internal combustion engine. Identify the compression ignition, compression ratio, compression pressure. Identify the lubrication system of Tractor engine Identify the various types of oil and their viscosities Identify the factors affecting oil deterioration – long usage contaminants Identify the cooling system of tractor engine Identify fuel system of a tractor engine Identify fuel injection Identify different types of injection pumps Identify the clutch system Identify Clutch system parts Identify types of clutch Identify gearbox system Identify the differences between manual and automatic gear box Identify types of gearbox Identify features of selective sliding gear type. Identify differential unit components Identify a steering Identify steering system of a tractor Identify mechanical steering. Identify hydraulic steering Identify hydraulically operated steering Identify the rack and pinion steering system Identify suspension system of a tractor
TRANSMISSION SYSTEM I CAM 232	Identify types of transmission system Identify components of transmission system Carry out function of the transmission system on a tractor tools used e.g. Clutch jig Carry out the use of clutch, PTO and hydraulic operation using a tractor.

	Identify categories of clutch systems Identify types of clutches Identify clutch assembly Identify clutch components Identify the different types of tools used in clutch maintenance Remove clutch assembly Dismantle/ assemble clutch assembly Set spring pressure and test compression of spring. Repair and /or replace worn or damaged parts. Identify types of drives and couplings Identify drive and coupling arrangement Carry out adjustments of drives and couplings Carry out maintenance • Remove and replace damaged and worn out parts • Lubrication. Sketch simple drive and coupling arrangement Carry out adjustment of line and coupling using a PTO drive Identify different types of bearings. Identify different types of transmission oil and greases. Identify defective bearings due to improper lubrication/ maintenance Visually check for wear and replace worn bearings. Identify different types of seals Identify the functions of the seals Identify different gasket materials Cut gasket of various shapes and sizes Identify where gaskets are used. Carry out replacement of damaged and /or worn out seals. Carry out use of gaskets on machine components/parts.
TRACTOR UNDERCARRIAGE CAM 233	Identify the functions of the undercarriage system. Identify major components of undercarriage Classify and describe the functions of components Recognize material properties and common wear patterns. Compare different tractor designs and their undercarriage systems. Identify Tractor Steering box Remove, dismantle, assemble and install steering boxes. Carry out steering adjustment using the caster and camber instruments and wheel alignment gauge.

	Diagnose and rectify faults in steering boxes. Carry out routine maintenance of steering system Identify the different types of spring Identify different types of wheels, rims and tire ply ratings. Remove, disassemble, assemble, and install suspensions. Change worn out or damaged parts of line suspension such as springs, dampers and shaft. Identify the following parts of the hydraulic system: • Hydraulic pump • Hydraulic piston • Hydraulic cylinder • Hydraulic line • Pipes • Seal • Ram Remove, service and install pumps Remove and discard used seals and install new seals and valves Demonstrate overhaul Remove, install, dismantle and assemble braking system. Carry out routine maintenance of hydraulic circuit of braking system. Change brake linings, brake pads and inspect brake drum. Identify brake pneumatic system. Maintain brake pneumatic system. Carry out efficiency test of braking system.
IRRIGATION EQUIPMENT CAM 234	Identify irrigation system components. Identify different irrigation systems for various crops. Performing routine maintenance tasks on irrigation systems Demonstrate the operation of an irrigation system Identify problems associated with irrigation system Diagnose faults by inspection of components Carryout troubleshooting techniques for resolving irrigation issues Dismantle system and fix defective components Carryout hands-on practical tasks related to irrigation system operation and maintenance Demonstrate safe and efficient operation of irrigation systems Identify types of water sources Identify types of pumps

	Identify types of valves Identify types of emitters/sprinklers Identify functions of each components Perform maintenance on each of the components Setup and demonstration irrigation system Assemble and install a drip irrigation system in a field plot i.e: connect the pump, pipes, valves, and emitters.
TRANSMISSION SYSTEM II CAM 311	Identify tractor circuit diagram Identify: • Ignition system • Secondary resistance cable Carryout charging operation principles of DC generator components and alternator charging circuit Interpret the tractor electrical system. Identify failures analysis on components and wiring Identify dry and wet battery cells. Identify the differences between wet and dry cell of a battery Carry out battery care Identify different battery terminals Identify ration of electrolyte mix and fill into the battery and carry out its routine maintenance Identify the components construction of a battery. Identify faulty starter motor Trouble shoot a starter motor system Identify: • Starting Relay • Voltage regulator • Cranking circuit Disassemble service and assemble a starter motor and replace faulty or worn out parts Identify alternators and dynamos identify various parts. Identify the difference between alternators and generators Conduct minor repairs on alternators Rectify or replace cut out relays and voltage regulators Conduct trouble shooting on alternators Demonstrate safety during cranking Conduct safe testing

	Carry out safe battery testing and handling
AUTO ELECTRICITY CAM 312	Identify tractor circuit diagram Identify: • Ignition system • Secondary resistance cable Carryout charging operation principles of DC generator components and alternator charging circuit Interpret the tractor electrical system. Identify failures analysis on components and wiring Identify dry and wet battery cells. Identify the differences between wet and dry cell of a battery Carry out battery care Identify different battery terminals Identify ration of electrolyte mix and fill into the battery and carry out its routine maintenance Identify the components construction of a battery. Identify faulty starter motor Trouble shoot a starter motor system Identify: • Starting Relay • Voltage regulator • Cranking circuit Disassemble service and assemble a starter motor and replace faulty or worn out parts Identify alternators and dynamos identify various parts. Identify the difference between alternators and generators Conduct minor repairs on alternators Rectify or replace cut out relays and voltage regulators Conduct trouble shooting on alternators Demonstrate safety during cranking Conduct safe testing Carry out safe battery testing and handling
HARVESTING AND POST HARVESTING CAM 313	Identify materials, tools and equipment for specific crop harvesting Identify methods of harvesting Identify crop maturity stages Identify proper crop harvesting time Identify harvesting method for specific crop to minimize looses

	Identify harvesting practices for specific crop to minimize loses Identify postharvest handling and postharvest technology Identify postharvest techniques Identify equipment and material used for postharvest operations of crops Identify the postharvest techniques for different crops Identify the facilities use for post harvesting operations Identify common post-harvest operations for crops Identify postharvest procedures for: • Cereals • Legumes • Roots and tuber crops Identify the procedure for grain treatment Identify the various crop storage structures Identify the types of crop storage structures Identify the features /criteria to consider for best crop storage structures Identify conditions necessary for best crop storage Identify fumigation process Identify the types of fumigants Identify factors for success and failure for fumigation Identify causes of loses in crop storage Identify essential storage activities before, during and after crop storage
MACHINERY MANAGEMENT CAM 321	Identify key factors influencing tractor selection Identify tractor types and their applications based on utility, row-crop, orchard Select tractor from standard chart based on given field data Compare different types of implements and their applications. Match tractors to implements based on power, size, and functionality. Use tools and resources to evaluate tractor-implement compatibility and performance. Analyze operational efficiency in tractor-implement pairing Select a tractor-implement combination for a specific farming operation based on given criteria Identify the role technology in modern tractor-implement systems Use digital tools to simulate machinery performance and schedule preventive maintenance. Prepare and present a detailed selection proposal justifying the selection decision based on technical, economic, and sustainability factors. Develop vendor evaluation and negotiation strategies to secure favorable purchase and service agreements.

	Maintain accurate records of evaluations, analysis
MAINTENANCE AND TROUBLESHOOTING OF TRACTORS CAM 322	Identify routine maintenance Identify key components of a tractor that require regular maintenance. Follow maintenance schedules and perform routine tasks: • Oil changes • Filter replacements Diagnose common tractor problems Identify problems in a given tractor Perform routine maintenance a tractor to address common issues. Identify tools and equipment for tractor maintenance and troubleshooting Carryout troubleshooting operation on a tractor Carry out maintenance activities Identify trouble shooting techniques Diagnose common engine problems using systematic troubleshooting methods Use electronics diagnostic tools Carry out troubleshooting activity on hydraulic system Carry out troubleshooting activity on cooling system Carry out troubleshooting activity on fuel system Assess transmission and drivetrain performance to detect abnormal vibrations and gear slippage. Analyze tire and wheel conditions for proper alignment, balancing, and wear patterns.
WHEELS AND TIRES CAM 323	Identify the components of a tractor tire Compare radial, bias-ply, and flotation tires and their applications. Select appropriate tires based on soil type, load capacity, and traction requirements. Identify tire pressure and its impact on performance. Demonstrate the process of checking and adjusting tire pressure Identify the function of tread patterns and their suitability for different terrains. Identify ballasting and its role in improving traction. Identify common tire issues Diagnose and resolve tire issues using systematic troubleshooting. Identify tire rotation and its impact on wear patterns. Demonstrate the process of adding ballast to tractor tires Identify the role of wheel alignment in tire performance. Identify the impact of improper tire maintenance on fuel efficiency and costs. Identify tire chains for improved traction in challenging conditions. Demonstrate the installation and removal of tire chains Follow safety protocols when working with tractor wheels and tires. Perform a detailed inspection of tractor wheels and tires

MAINTENANCE OF PRECISION AGRICULTURAL EQUIPMENT AND MACHINES CAM 331	Identify the operational principles behind GPS guidance, sensor integration, and variable rate application systems. Identify how precision equipment integrates hardware and software to achieve field accuracy. Conduct comprehensive visual and digital inspections of precision ag systems. Use diagnostic tools to assess sensor health and connectivity. Perform precise calibrations of GPS and RTK systems to ensure optimal accuracy. Adjust sensor arrays and control units using manufacturer-specified procedures. Update firmware and perform software diagnostics on integrated precision systems. Troubleshoot data logging errors and system integration issues Assess environmental factors that affect equipment performance and recommend protective measures. Follow strict safety protocols when handling sensitive electronics and high-voltage components. Update firmware and perform software diagnostics on integrated precision systems. Troubleshoot data logging errors and system integration issues using simulation tools. Develop and implement a preventive maintenance schedule based on equipment usage and environmental conditions. Document calibration settings, repair actions, and system performance in an electronic logbook. Integrate sensor data into farm management software and analyze trends for maintenance planning. Prepare detailed technical reports and present data-driven recommendations to stakeholders.
TRACTORS AND THEIR POWER UNIT CAM 332	Identify internal combustion Identify the layout of an internal combustion engine Identify the following: • Two Stroke cycle Engine • Four Stroke cycle Engine Identify the working principle of two strokes cycle engine. Identify the working principle of four Stroke cycle engine Differentiate between two stroke cycle engine and four stroke cycle engine Identify the following: • Compression ignition • Compression ratio

	• Compression pressure Interpret measurements and compression reading relative to Power Unit. Identify diesel fuel components: • Fuel pump • Fuel tank • Fuel lures • Fuel filter • Fuel injector • Nozzles etc. Identify the various components of fuel system Differentiate between petrol and diesel fuel system Identify the working principle of the fuel lift pump, in line and distributor injection, pump, filters injectors, governors and cold starting Identify the injection Identify injection in diesel engines Identify the different types of injection pumps Identify the working principle of different types of injection pumps Identify the cooling system of a tractor Identify the working principles of tractor cooling system Identify radiator and its components Identify the functions of pressure cap Identify main faults of cooling system parts • Radiator • Fan & Fan belts • Water pump • Thermostat Identify the lubrication system of a tractor Identify different types of lubricating systems Identify lubricating oil and filters Identify the effects of oil thickening on lubrication Identify the various types of oil and their viscosities Identify the factors affecting oil deterioration

CRAFTSMAN AND MASTER CRAFTSMAN COURSES IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANICS WORK TOOLS REQUIRED

S/NO	TOOLS/EQUIPMENT	MINIMUM QUANTITY REQUIRED
A	**ENGINE MAINTENANCE AND REPAIR TOOLS**	
	Tools box	
1	Sets of Open-End Spanners – 6mm-32mm	1Set
2	Big Open-End Spanners	1Set
3	Ring Spanners – 6mm-32mm	1Set
4	Sets of Pocket Spanners – 6mm-32mm	1Set
5	Pre-adjustable torque wrenches	17
6	Small, medium and big adjustable spanner	5sets
7	Pipe Wrenches (assorted sizes)	5sets
8	Vice grip wrench	5sets
9	Set of Allen keys	5sets
10	Feeler gauges	5sets
11	Portable cranes	1
12	Pressure gauges	2sets
13	Micrometer	7
14	Steel Rule	32
15	Straight Edge	32
16	Wing Dividers	10
17	Scribers	32
18	Inside and Outside Callipers	32
19	Hydrometer	2
20	Set of Clutch Alignment Gauge	2
21	Clutch Set – screw gauge	2
22	Oil cans	10
23	Plug Gauge	10
24	Gap Gauge	10
25	Ring Gauge	10
26	Engineer’s Compass	5
27	Vacuum Tester	2
28	Air Compressor	1

S/NO	TOOLS/EQUIPMENT	MINIMUM QUANTITY REQUIRED
29	Grease Guns	3
30	Fire Extinguishers	5
31	Portable Hoist	1
32	Hydraulic Jack	1
33	Assorted Grinders	5
34	Work Bench (1m x 2m)	15
35	Power Hacksaw	2
36	Engine Stands	2
37	Creepers	2
38	Ramps	2
39	Dust Bin	3
40	First Aid Box	1
41	Battery Charging Equipment	1
42	Set of Pullers	1
43	Stand by Generators	2
44	Hydraulic Press	1
45	Valve Grinder	1
46	Wheel Alignment Gauge	1
47	Wheel balancing tools	1
48	Injector Testing Machine	1
49	Injector Needle service Kit	1
B	**LATHE MACHINE AND EQUIPMENT**	
1	Lathe Machine (1-1.5m) (manual)	4
2	Ploughing Tools	Set
3	Finishing Tool	Set
4	Rounding Tool	Set
5	Right hand turning tool	Set
6	Left hand turning tool	Set
7	Right hand side tool	Set
8	Screw thread cutting tool	Set
9	Brass cutting tool	Set
10	Cutting off tool	Set
11	Knurling tool	Set

S/NO	TOOLS/EQUIPMENT	MINIMUM QUANTITY REQUIRED
12	Chasing tool	Set
13	Coolant	100 Litres
14	Wire brush	10
C	**MEASURING TOOLS**	
1	Inside caliper	6
2	Outside caliper	6
3	Micrometer Screw Gauge	6
4	Thread pitch gauge	6
5	Vernia Caliper	6
6	Steel tape	30
7	Steel Rule	30
8	Cutter bit gauge	Set
9	Radius Gauge	Set
10	Tract or walking tape	2
11	Square	20
12	Straight edge	10
13	Protractors	10
14	Dividers	10
15	Centre square	2
16	T square	2
D	**AGRICULTURAL WELDING EQUIPMENT (SOLDERING EQUIPMENT)**	
1	Blow Torch	3
2	Soldering Copper	5boxes
3	Files	5 Sets
4	Tin Snips	5
5	Soldering Flux	5tins
6	Granulated Soil ammoniac and water	5tins
7	Half and Half Solder	5tins
8	Acid-core wire solder	5tins
9	Resin-core wire solder	5tins
10	Emery Cloth	10packets

S/NO	TOOLS/EQUIPMENT	MINIMUM QUANTITY REQUIRED
11	Sand paper	10packets
12	Sheet Metal Paper	10packets
13	Wire Brush	10
14	Tong	2
15	Anvil	2
16	Mallet hammer	5
17	G Clamp	6
18	Hacksaw/Blade	32
19	Marking Gauge	2
20	Try square	30
21	Water Bath	1
22	Axle Stand	4
23	Leather Gloves	32
24	Soldering table	1
25	Tower	1
26	Thermostat	5
27	Liquid flush	10
28	Soldering iron	3
29	Lead	1 roll
30	Forging tools	3 sets
E	**AGRICULTURAL WELDING EQUIPMENT (GAS WELDING)**	
1	Oxygen and acetylene bottle on a cart	2Sets
2	Oxygen and acetylene regulators	10 sets
3	Oxyacetylene welding cutting outfit	2Sets
4	Oxygen and acetylene hoses	1reel each
5	Welding goggles	Assorted
6	Welding nozzles	2 set
7	Welding tips	2
8	Cylinder wrenches	2
9	Spark Lighter	10
10	Welding rods	2packets
11	Welding Fluxes	2tins
12	PPE	2

S/NO	TOOLS/EQUIPMENT	MINIMUM QUANTITY REQUIRED
13	Straight pen hammer	2
14	Round hammer	2
15	Anvil	1
F	**AGRICULTURAL WELDING EQUIPMENT (ARC WELDING)**	
1	Arc Welding Machine	3
2	Electrodes	30pkt
3	Electric Grinder	2
4	Welding table	2
5	Welding Leather gloves	30
6	Arc Welding Helmet	15
7	Carbon Arc Touch	15
8	Chipping Hammer	5
9	G Clamp	15
10	Clear Goggle for Chipping	15
11	Dressing wheels	5
12	Vice	20
13	Hardie for anvil	2
14	Files	Assorted
15	Electro-spot welder	1
16	Cold Chisels	5
17	Welding cables	1 ream
18	Welding handle	3
G	**EQUIPMENT AND OTHER ACCESSORIES**	
1	Grinding wheel	2
2	Drilling Machines	2
3	Punches	Assorted
4	Pillar Drill Bits	2
5	Storage Cabinet	5
6	Tap and dies	Assorted
7	Machine Wrench	Assorted
8	Oil Stone	2
9	Hammer	Assorted

S/NO	TOOLS/EQUIPMENT	MINIMUM QUANTITY REQUIRED
10	Knock-out bar	5
11	Drill bits	Assorted
11	Countersink bit	1set
12	Centre head	3
13	Soluble Oil	200 litres
14	Counter bore bit	1 Set
15	Cooling Tank	3
16	Gear Oil	30 litres
17	Engine oil	30 Litres
18	Side Table	6
19	Broom	12
20	Brush	12
21	Scrappers	6
22	Blasting equipment	1
23	Charts	Assorted
24	Head pan	10
25	Gum/ Adhesives	Assorted
26	Industrial Cotton Waste	5 sacks
27	Milling machine	2
28	Round metal bar	
29	Alloying materials	2
30	Bench vice	10
31	Arc table	5
32	Coupler furnace	1
33	Metal sheets	Assorted
34	Riverting tools	2 sets
35	Mallets	5
36	Regroupers	5
37	Snipers	5
38	Forge tongs	2
39	Pliers	10
40	Power hack saw	1
41	Table hand saw	10

S/NO	TOOLS/EQUIPMENT	MINIMUM QUANTITY REQUIRED
42	Reaming tools	5
43	Scribing blocks	2
H	**TRACTORS AND IMPLEMENTS**	
1	Tractors and trailers	1 each
2	Power tiller	1
3	Disc Ploughs	1
4	Mould board Plough	1
5	Disc Harrow	1
6	Spring time Cultivators	1
7	Rotavators	1
8	Seed Drills and Planters	1 each
9	Inter-row weeders	1
10	Straddle Row weeders	1
11	Knapsack sprayers	5
12	Boom Sprayer	1
13	Fertilizer Spreader	1
14	Manure distributor	1
15	Cutterbar Mowers	1
16	Flail Mowers	1
17	Forage Harvester	1
18	Hay Balers	1
19	Combine Harvester	1
20	Potato Digger	1
21	Groundnut Lifters	1
22	Yam and cassava diggers	1
23	Backup Truck	1
24	Driven implements	1
25	Mounted implements	1
26	Trill implements	1
27	Tractor model engine	1
28	Disc blade	5
29	Disc bearing	5
30	PTO	1

S/NO	TOOLS/EQUIPMENT	MINIMUM QUANTITY REQUIRED
31	Hitch	1
32	Clutch assembly	1
33	Clutch jig	1
34	Universal join coupling	1
35	Bearings	Assorted
36	Cotton picker	1
37	Reciprocating mower	1
38	Milking machine	1
39	Cream separator	1
40	Cooling machine	1
41	Milk storage machine	1
42	Pasteuriser	1
43	Alloy feeding system	1
44	Tractor axil	1
45	Linkages	2
46	Steering box	1
47	Tarpaulin	5
48	Mat driers	5
49	Winnowers	2
50	De-stoner	1
51	Mechanical sheller	1
52	Sieve	2
53	Bags and sacks	10
54	Plastic creates	10
55	Wooden creates	10
56	Portable silo	1
57	Hermetic bags	10
58	Portable Rumbu	1
59	Fumigants	Assorted
60	First Aid Box	2
61	Soil engaging components	2
62	Planters	1
63	Seed drills	1

S/NO	TOOLS/EQUIPMENT	MINIMUM QUANTITY REQUIRED
64	Cultivators	1
I	**BASIC AGRICUTURAL SCIENCE**	
1	Rocks	Assorted
2	Wheelbarrow	3
3	Watering can	3
4	Shovels	5
5	Diggers	3
6	Sample bags	50
7	Soil pH scale	5
8	Crop	Assorted
9	Animal species	Assorted
10	Poultry birds species	Assorted
11	PPE	2
12	Combine Harvesters	1
13	Threshers	1
14	Winnowers	1
15	Balers	1
16	Mowers	3
17	Rakes	5
J	**IRRIGATION**	
1	Model gear box	1
2	Gear teeth	Assorted
3	Irrigation system model	2
4	Pressure gauge	2
5	Filters	5
6	Ammeters	5
7	Valves	5
8	Maintenance tools	1
9	PPE	1
10	Water pump	2
11	Hoses	Assorted

S/NO	TOOLS/EQUIPMENT	MINIMUM QUANTITY REQUIRED
K	**ELECTRICAL**	
1	Alternator	
2	Battery charge	
3	Wires	
4	Cables	Assorted
5	Relay	Assorted
6	Circuit diagram	1
7	Avometer	2
8	Hydrometer	2
9	Electrolytes	2
10	Dry and weight batteries	1 each
11	Starter motor	1
12	Voltage regulator	1
13	Solenoid	1
14	Dynamos	1
15	Armature	1
16	Screw driver	Assorted
17	Pilers	assorted
18	Cellotape	10
19	Logbook	Assorted
20	Inverter	1
21	Inverter cables	various
22	Solar Battery Bank	2
L	**ALTERNATIVE ENERGY**	
1	Wires	5 rolls (Assorted)
2	Relays	20(Assorted)
3	Multimeters	5
4	Circuit diagram	5(Assorted)
5	Alternator	2
6	Dry and wet batteries	2
7	Electrolyte	1
8	Hydrometer	3
9	BAterry Charger	1

S/NO	TOOLS/EQUIPMENT	MINIMUM QUANTITY REQUIRED
10	Starter Motor	2
11	Selonoid	3
12	Armature	3
13	Dynamos	3
14	Voltage regulators	3
15	Pliers	5
16	Selotape	10
17	PPE	3
M	**MACHINERY MANAGEMENT**	
1	Tractors Date sheets	5
2	Implements date sheet	5
3	Cost calculators	2
4	Fuel and maintenance records	2
5	GPS	2
6	Digital Tools	2
7	Logbooks	5
N	**TROUBLE SHOOTING AND MAINTENANCE**	
	Diagnostic equipment	2
	Fan belts	8
	Filters	10
	Safet gears	2
	Lubricants	5
	TArctor maintenance manuals	5
	Technical bulletins and schematics	5
	National safety standards	2
	Electronic logbooks	10
	Maintenance check list folders	5
	Softwares	5
O	**TYRE MAINTENANCE**	
	Tyre samples	6
	Pressure gauges	4

S/NO	TOOLS/EQUIPMENT	MINIMUM QUANTITY REQUIRED
	Punture repair kits	6
	Ballasting equipment	2
	Tyre chain	4
	PPE	2
	Liquid ballast	2
	Weights	6
P	**SAFETY EQUIPMENT**	
1	Hard Hats	6
2	Safety glasses	4
3	Earplugs	6
4	Steel-toed boots	2
5	First aid kits	4
Q	**ICT AND EDUCATIONAL EQUIPMENT**	
1	Computers and Laptops	6
2	Projectors and Screens	4
3	Interactive whiteboards	6
4	Agricultural software	2
5	Educational Videos and DVDs	4
R	**CROP PROCESSING EQUIPMENT**	
1	Grain Dryers	6
2	Grain Cleaners	4
3	Seed Cleaners	6
4	Oil extractors	2
5	Milling machines	1
S		
1	Greenhouse or shade house	1
2	Soil testing equipment	1
3	Weather monitoring equipment	1
4	Fertilizer and pesticide application equipment	2

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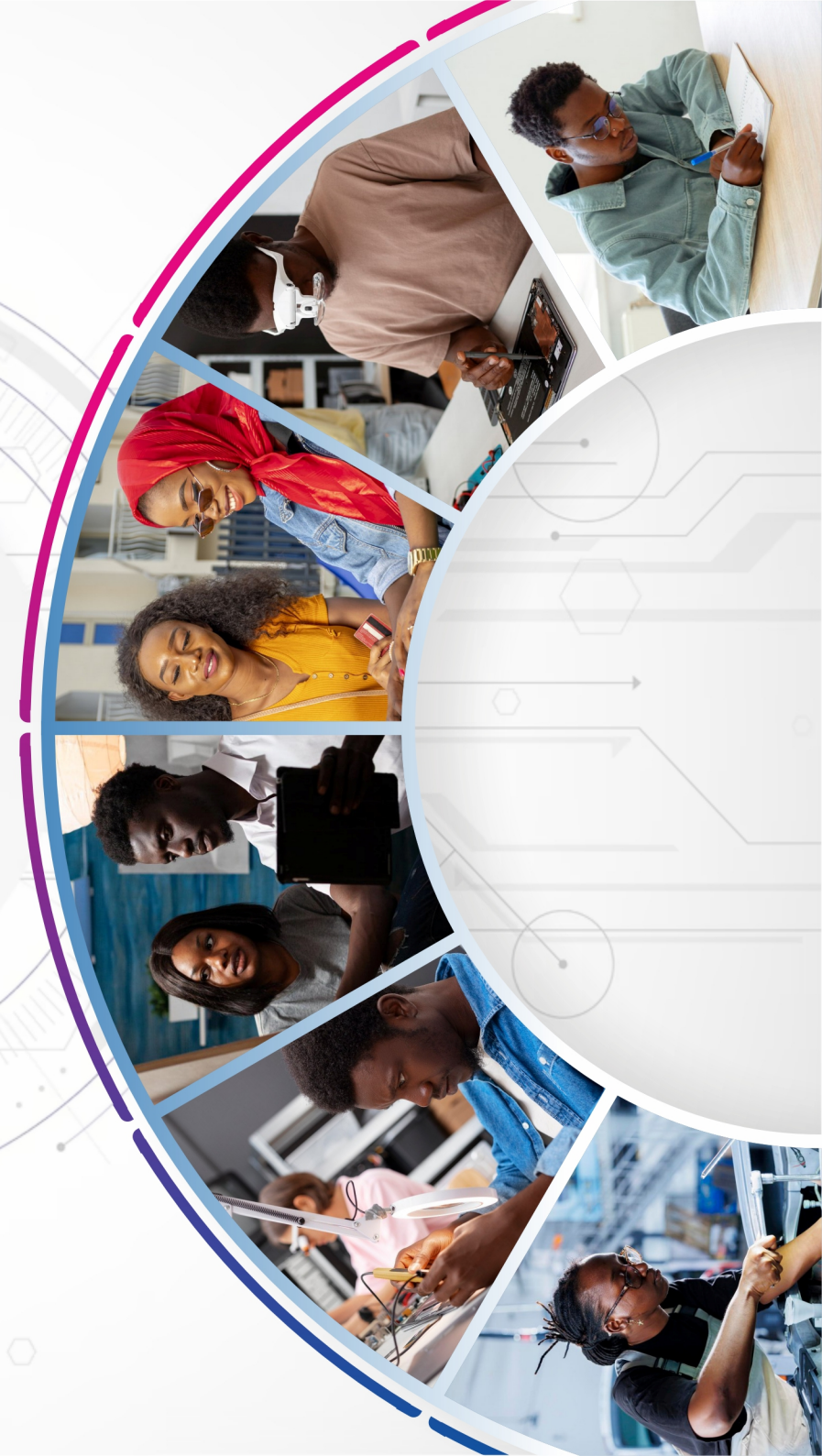

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