

FEDERAL MINISTRY OF EDUCATION

National Technical Certificate (NTC) Curriculum in

AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANICS WORK CRAFT PRACTICE

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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

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PROGRAMME:NATIONAL TECHNICAL CERTIFICATE IN AGRICULTURAL EQUIPMENTAND 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	YE	AR 1	L				YF	EAR	2				YEA	AR 3					Total Hours
			Ter	rm 1	Ter	·m 2	Te	rm 3	Te	Term 1 Term 2 Term			Term 3 Term 1		Term 2 Term		m 3				
			Т	Р	Т	Р	T	Р	Т	Р	Т	Р	Т	Р	T	Р	Т	Р	Т	Р	
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

CURRICULUM AND MOUDULE SPECIFICATIONS IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANICS WORK CRAFT PRACTICE

		GRAND TOTAL	14	11	14	11	14	11	14	17	14	17	14	19	16	18	16	18	15	14	3204
33	CAM 332	Tractors and their Power Unit																	2	3	72
32	CAM 331	Precision Agriculture																	1	2	72
31	CAM 323	Wheels and Tires															1	2			72
30	CAM 322	Maintenance and Troubleshooting of Tractors															1	3			144
29	CAM 321	Machinery Management															2	1			144
28	CAM 313	Harvesting and Post Harvesting													2	1					72
27	CAM 312	Auto Electricity													2	4					144
26	CAM 311	Transmission System II													2	4					72
25	CAM 234	Irrigation Equipment											2	2							72
24	CAM 233	Tractor Undercarriage											2	4							72
23	CAM 232	Transmission System I											2	4							72
22	CAM 231	Tractor and its components II											1	3							72
21	CAM 222	Implements and Machines II									1	2									72
20	CAM 221	Tractor and its Component	5								1	3									72
19	CAM 213	Machining Operations I							1	3											72
18	CAM 212	Implements and Machines							1	2											72
17	CAM 211	Alternative Energy Mechanization							2	1											72

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	e fundamentals of general Health, Safety a	nd Environment.						
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								

MODUI YEAR:	LE: HEALTH, SAFETY AND E		UBJECT CODE: RE: REQUISITE	: TH	ONTACT HOURS: IEORETICAL <mark>:</mark> ACTICAL:	
GOAL:	This module is designed to intro	oduce the trainee to the fund	lamentals of gener	al Health, Safety and Enviro	iment.	
THEOR	ETICAL CONTENT			PRACTICAL CONTENT	I.	
GENER	AL OBJECTIVE 1.0: Understan	nd the application of safety	rules and regulation	ons in the workplace/environ	nent	
WEEK	SPECIFIC LEARNING	TEACHER'S	RESOURCES	SPECIFIC LEARNING	TEACHER'S	RESOURCES
	OUTCOME	ACTIVITIES		OUTCOME	ACTIVITIES	
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. 	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		Identify safety equipment and wears essential in the workplace/environment Demonstrate how to use safety equipment and wears essential in the	Guide students to: Identify safety equipment and wears essential in the workplace/ environment Demonstrate how to use safety equipment and wears essential in	Farm tools box PPE Television Video Player
	1.3 State the application of 1.2 above in working situations	 Safety boots Helmet Fire extinguishers etc. Explain the application of 1.2 above in working situations 		workplace/environment	being basic hand tools	

1.4 Outline safety rules and regulations relating to:	Explain safety rules and regulations relating to:	Demonstrate safe handling basic h		n
 PPE Tools handling and storage Fire protection equipment etc. 	 PPE Tools handling and storage Fire protection equipment etc. 	Show a film on i safety	industrial safe	

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

	ii. Chemicals hazards	Demonstrate the procedures of workplace
 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 	 Exposure to chemicals in the workplace, such as cleaning products or industrial chemicals Can cause skin irritation, respiratory issues, blindness, corrosion and explosions Physical hazards Unsafe working conditions that can cause injury, illness and death Hazards that leads to slip, trips and falls. 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 	to be taken in the event of workplace accident

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

Identify hazard Identify hazard Identify hazard Mazard Mazard Mazard Methods of collecting, Demonstrate	8-10	3.1 Define Safe Work	Explain Safe Work	Safety posters		Guide students to:	SWP Manual
3.2 State the purpose of a safe work procedure: Explain the purpose of a safe work procedure: Marker • Identify hazard • Identify hazard Computer Demonstrate different methods of collecting, Plastic collection		Procedure	Procedure		Identify safe work procedure		Course 1 area of a
work procedure: safe work procedure: Marker • Identify hazard • Identify hazard Computer • Assess risks • Assess risks Demonstrate different methods of collecting,				Projector			Sample waste
Identify hazard Identify hazard Assess risks Assess risks Demonstrate				Marker			
• Assess risks Assess risks Literate methods of collecting, Demonstrate		 Identify hazard 	 Identify hazard 	Computer	Demonstrate different		Plastic collector
• Assess fisks • Assess fisks Internet treating and disposing of different methods of		5	-	.	methods of collecting,	Demonstrate	
• Implement controls • Implement				Internet	treating and disposing of	different methods of	
		Train workers	controls		waste in workplace	collecting, treating	

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

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

CURRICULUM AND MOUDULE SPECIFICATIONS IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANICS WORK CRAFT PRACTICE

	ASSESSMENT CRIT	ERIA		
	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 knowle	dge of basic workshop tools, equipmer	nt 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 2.0 Understand the operation, care and storage of basic tools and equip 3.0 Understand the basic safety procedures and practices as well as good 4.0 Understand the culture of maintenance and care for both the environic safety procedures and practices and practices as well as good 	ment od practices regarding the use and stora	ıge.

PROGRAM MODULE:	USE OF WORKSHOP TOOL					CONTACT HOURS: 84 THEORETICAL: 36 HO	
YEAR: 1	TERM: 2]	PRE: REC	QUISITE:	PRACTICAL: 48 HOUR	S
GOAL: T	his module is designed to introdu	ice the trainee with know	vledge of	basic world	kshop tools, equipment and	infrastructure	
	TICAL CONTENT				PRACTICAL CONTENT		
	OBJECTIVE 1.0: Understand						
WEEK	SPECIFIC LEARNING OUTCOME	TEACHER'S ACTIVITIES	RESO	URCES	SPECIFIC LEARNING OUTCOME	TEACHER'S ACTIVITIES	RESOURCES
1	1.1 Define workshop hand tool and equipment.	Explain workshop hand tool and	Whiteb Project	or	Identify workshop hand to		Screwdrivers
	1.2 Describe how to select	equipment.	Marker Compu	ter	and equipment.	hand tool and equipment.	Hammers
	tools for a particular task	Explain how to select tools for a particular	Internet Slides		Identify how to select tools		Wrenches
		task	Textbo	oks	for a particular task	select tools for a particular task	Pliers
	1.3 Describe how to use						Chisels
	appropriate hand tool and equipment	Explain how to use appropriate hand tool and equipment			Identify how to use appropriate hand tool and equipment	Identify how to use appropriate hand tool and equipment	Hand saws
	1.4 Describe basic hand tool and their	Explain basic hand			equipment	Identify basic hand	Measuring tool
	importance:	tool and their			Identify basic hand tool an	d tool and their	C:1
	ScrewdriversHammers	importance:Screwdrivers			their importance	importance	Circular saws
	WrenchesPliers	HammersWrenches				Identify power tools	Drills, sanders Power routers
	ChiselsHand saws	 Pliers Chisels			Identify power tools and the significance	and their significance	Jigsaws
	• Measuring tools etc.	Hand sawsMeasuring tools			Significance	Identify special tools and how to	Power nailers
	1.5 Describe power tools and their significance:	etc.			Identify special tools and how to use them	use them	Welding equipment

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

GENERAL	OBJECTIVE 2.0: Understand	the operation, care and st	torage of basic tool	s and equipment		
	2.1 Describe how to organize and store your workshop tools through planning	Explain how to organize and store your workshop tools	Whiteboard Projector Marker	Identify how to organize and store your workshop tools	Guide trainees to: Identify how to organize and store	Tool cabinet Wall mounted
	 your workshop: Assessing space Workstation placement 	 through planning your workshop: Assessing space Workstation 	Computer Internet Slides Textbooks	Identify storage solutions for tools	your workshop tools Identify storage	storage Toolboxes
	 Tool accessibility Safety considerations 	 placement Tool accessibility Safety considerations 		 Tool cabinet Wall mounted storage Toolboxes and totes Tool foam inserts 	 solutions for tools Tool cabinet Wall mounted storage Toolboxes and 	Totes Tool foam inserts
		5			0	

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

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

CURRICULUM AND MOUDULE SPECIFICATIONS IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANICS WORK CRAFT PRACTICE

Machinery		
guarding		

5.1 Describe Workshop	Explain Workshop	Whiteboard		Guide trainee to:	HSE
safety guidelines:	safety guidelines:	Projector	Identify Workshop safety	Identify Workshop	
 Familiarize yourself with tools Proper tool use Workspace organization Electrical safety Fire safety Tool handling 	 Familiarize yourself with tools Proper tool use Workspace organization Electrical safety Fire safety Tool handling 	Marker Computer Internet Slides Textbooks	guidelines Identify ways of keeping the workshop clean and tidy	safety guidelines Identify ways of keeping the workshop clean and tidy	
 5.2 Describe ways of keeping the workshop clean and tidy Regular cleaning Waste management Material storage Cable management 	Explain ways of keeping the workshop clean and tidy Regular cleaning Waste management Material storage Cable management				

Assessment profile: Practical to take 60% of overall assessment

MODULE: BASIC AGRICULTURAL SCIENCE	SUBJECT CODE: CAM 113	CONTACT HOURS	
YEAR: 1 TERM: 1	PRE: REQUISITE:	THEORETICAL:	
		PRACTICAL:	
GOAL: This module is designed to provide trainee with know	ledge of soil science, crop and animal husbandry.		
1.0 Know soil formation and its properties.2.0 Understand soils and their effects on agricultural implement	S.		
	S.		
2.0 Understand soils and their effects on agricultural implement	S.		

	AMME: NTC IN AGRICULT LE: BASIC AGRICULTURAL			COURSE CODE: CAM 113			HOURS: 120 CAL:
YEAR: 1	1 TERM: 1			PRE: REQUISITE: PRACTICA			
GOAL:	This module is designed to provi	de trainee with knowledge of	soil science, crop ar				
THEOR	ETICAL CONTENT			PRACTICAL CONTEN	Т		
GENER	AL OBJECTIVE 1.0: Know soil						
WEEK	SPECIFIC OBJECTIVES	TEACHER'S ACTIVITY	RESOURCES	SPECIFIC LEARNING OUTCOMES	TEACHE ACTIVII		RESOURCES
1-3	1.1 Define soil	Explain soil	Marker/chalk, Whiteboard/blac	Identify types soil	Guide trai Recognize Recognize	e types of soil	Soil samples, Rocks, Shovels, Diggers, Sample
	 1.2 Define rock 1.3 Define the following: Parent rock Sub soil Top soil. 	 Explain rock Explain the following: Parent rock Sub soil Top soil. 	kboard, Charts, Projector, Computer, Internet, Textbooks, Slides	Identify rocks Identify Parent rock, Sub soil and Top soil.		e Parent rock, nd Top soil.	bags
	1.4 Define weathering	Explain weathering		-			
	1.5 List the types of weathering	Explain the types of weathering		Identify types of weathering	Identify ty weathering	*	
	1.6 Explain the mechanics of weathering.	Explain the mechanics of weathering		Identify mechanics of weathering	Identify m weathering	echanics of	
	1.7 Understand soil structure and consistency.	Explain soil structure and consistency		Identify soil structure and consistency	Recognize and consis	e soil structure stency	
				Identify the following:			

 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 microorganisms Organic matter 	
GENERAL OBJECTIVE 2.0: Understand 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.	 soils and their effects on agri 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 	icultural implement Marker/chalk, Whiteboard /blackboard, Charts, Projector, Computer, Internet, Textbooks, Slides	s 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.			1	
		Explain the soli pri scale.			Perform soil pH test	
				Carryout soil pH test		
	RAL OBJECTIVE 3.0: Understand		•			
6 -7	3.1 Describe seed germination.3.2 Explain the requirements for seed germination.	Explain seed germination Explain the requirements for seed germination.	Marker Whiteboard Charts Projector Computer Internet	Carry out seed germination Identify requirements for seed germination.	Guide trainees to: Carry out seed germination Identify Requirements for seed germination.	Crop, seed, Flower, hoe
	 3.3 Describe essential soil nutrients: Micro nutrients Macro nutrients 	Explain the essential soil nutrients:Micro nutrientsMacro nutrients	Textbooks Slides	Identify the essential soil nutrients (micro and macro nutrients).	Recognize the essential soil nutrients (micro and macro nutrients).	
	3.4 List the functions of the essential nutrients in the crop.	Explain the functions of essential nutrients in the crop.			-	
GENE	RAL OBJECTIVE 4.0: Understand	plant growth and reproduction	on.		•	•
7-9	4.1 Define photosynthesis and respiration4.2 Describe the processes of photosynthesis and respiration	Explain photosynthesis and respiration Explain the processes of photosynthesis and respiration.	Marker Whiteboard Charts Projector Computer Internet Textbooks Slides		Guide trainees to:	Crop, flowers, seedlings, hoe
	4.3Describe the functions of part s of a crop flower.	Explain the functions of parts of a crop flower				
	4.4 Describe the process of fertilization and fruits formation.	Explain fertilization and fruits formation.				

GENER	AL OBJECTIVE 5.0: Know diffe	erent species of animals and th	neir management re	quirements.		
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 	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.	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	Guide trainees to: Visit poultry and secluded animal grazing farms. Recognize various species of animals and poultry birds	Species of animals and poultry birds Houses for poultry birds and animals, Equipment used in different animal houses, Logs, woods, zinc, straws etc
	5.5 Describe the different uses of equipment in poultry birds and animal houses.	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.		Identify various type of housing required for each of poultry birds and animals Identify different equipment used for poultry birds and animal houses.	Recognize type of housing required for each of poultry birds and animals Identify different poultry birds and animal houses.	

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

MODULE: GENERAL METAL WORK I	SUBJECT CODE: CAM 121	CONTACT HOURS:
YEAR: 1 TERM: 2	PRE: REQUISITE:	THEORETICAL:
		PRACTICAL:
ENERAL OBJECTIVE: On completion of this module,	the trainee should be able to:	
GENERAL OBJECTIVE: On completion of this module,	the trainee should be able to:	
1.0 Understand ferrous and non-ferrous metals.		
1.0 Understand ferrous and non-ferrous metals.		
 GENERAL OBJECTIVE: On completion of this module, 1 1.0 Understand ferrous and non-ferrous metals. 2.0 Know the selection of common measuring, marking our 3.0 Know the principles of drilling machine for various drilling 	t, cutting and striking tools.	

PROGR		NICAL CERTIFICATE IN					
MODUL	E: GENERAL METAL WOR	K I	COURSE CO		CONTACT HOURS: 84		
				1	HEORETICAL:36 HOUL	RS	
YEAR: 1 TERM: 2		PRE: REQU	ISITE: F	RACTICAL: 48 HOURS			
	This module is designed to equip	p the trainee with the knowled	lge and skills of ger				
	ETICAL CONTENT			PRACTICAL CONTEN	Т		
	AL OBJECTIVE 1.0: Understar			1			
WEEK	SPECIFIC LEARNING	TEACHERS	RESOURCES	SPECIFIC LEARNING	TEACHERS	RESOURCES	
	OUTCOME	ACTIVITIES		OBJECTIVES	ACTIVITIES		
1-3	1.1. Define metal		Marker	Identify metals	Guide student to:	Cupola furnace,	
1			White Board		Identify metals	PPE, Plain	
	1.2. Discuss the following	Explain metal	Smart board			carbon steels,	
	general physical		Textbooks			Cast iron, Alloy	
	properties of metals:-	Explain the following	Slides	Identify general physical	Recognize general	steel, Copper,	
	Ductility	general physical properties of metals:	Diagrams	properties of metals	physical properties of metals	Tin, Zinc, Aluminium	
	Malleability		Projector Computer		metals		
	• Strength	• Ductility	Internet			alloys, Brass metal	
	• Toughness	Malleability	Charts			metai	
	• Brittleness	• Strength	Video player				
	• Elasticity	Toughness	video player				
	• Plasticity	• Brittleness	•				
		• Elasticity					
		• Plasticity					
	1.3 Define ferrous metals	Explain ferrous metals		Identify basic properties of carbon steels, cast iron and alloy steel			
	1.4 Describe the application of ferrous metals	Explain the application of ferrous metals					
	1.5 Define non-ferrous metals	Explain non-ferrous metals					

			ſ		· · · · · · · · · · · · · · · · · · ·	
 1.6 Describe the of non-ferrous Copper Tin Zinc Aluminum Brass met Cartridge metal etc. 	metals: n m alloys	 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 properties Plain c Cast in Alloy 	of: arbon steels on	 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 ap above in fa	plication of 1.7 brication	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 cuj	oola 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	
3- 5	 RAL OBJECTIVE 2.0: Know the 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 	Explain measuring instruments Explain the following Common measuring Marking out Cutting Striking tools Explain the differences between "line" and "end" measurement.	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	Guide student to: Identify common measuring tools Identify difference between "line" and "end" measurement	Micromete r,vernier caliper, Vernier height, gauge, Steel rules, Dividers Punches, Trammel, Scribers, Angle plate, Vee block
	points, datum lines and datum faces in marking out.	Explain the use of datum points, datum lines, and datum faces in marking out.		Identify the use of datum points, datum lines and datum faces in marking out.	Carryout the use of datum points, datum lines and datum faces in marking out.	, Center square, Flat file, Try
	2.5 Describe the functions of the following marking out tools:Steel rule	Explain the functions of the following marking out tools:		Identify steel rule, dividers, caliphers, scribers etc.	Carry out marking out using steel rule, dividers, calipers, scribers etc.	square, Hacksaw, Adjustable hacksaw,

	• Dividers	• Steel rule			Bench
	• Calipers (inside,	• Dividers			vice
	outside and odd-legs)	• Calipers (inside,			
	• Trammel	outside and odd-			
	• Scriber	legs)			
	• Angle plate	• Trammel			
	• Vee-block	• Scriber			
	• Centre square	• angle plate			
		Vee-block	Identify file tool		
	2.5 Define File tool	• Centre square.	·	Recognize file tool	
			T1		
	2.6 Describe the various types	Explain file tools	Identify types of files		
	of files	-	Identify common files for	Identify the types of files	
		Explain the various types	metal work	Carry out filling operations	
	2.7. Discuss the applications	of files		using common file for metal	
	of files			work	
	2.8 Classify the common files	Explain the application of files	Identify filing operations		
	used in metal work	mes		Perform filing operations	
		Explain common files			
		used in metal work	Lintifer for stiene of a stien		
	2.9 Describe a bench vice		Identify functions of a vice	Recognize bench vice	
			Identify various parts of	Recognize bench vice	
			bench vice		
	2.10 Explain the function of a bench vice	Explain a bench vice		Identify various parts of	
	bench vice		Use bench vice clamping	bench vice	
2.	11 Describe bench vice	Explain the function of a			
	clamping power	bench vice		Carry out bench vice	
			Domonstrato working or	clamping	
		Explain bench vice	Demonstrate working on the vice for filling and		
2	.12 Describe the technique of	clamping power	tapping operations	Perform holding work on the	
	holding work on the vice		The second secon	vice for filling and tapping	
	for filing and tapping			operations	
	operations.				

 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 	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 u hacksaw	observing
	when using a hand hacksaw		

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

3.4 Define drill bit	Explain drill bit	Projector Textbooks Slides	Identify the main features of bench or pillar drilling machine	Sketch the main features of bench or pillar drilling machine	Reaming tool Scientific Calculator
 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. 	 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. 		 Identify the following: 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. 	
 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. 	Explain the faults in a ground twist drill bit as in 3.6		Identify the effects of following faults in a ground twist drill as in 3.6	Identify the effects of following faults in a ground twist drill as in 3.6	
3.7 Explain how to calculate spindle revolution or cutting speed for specified size of drill using the formulae:- $N = 1000S/\pi d$ $S = \pi dN/1000$	Explain how to calculate spindle revolution or cutting speed for specified size of drill using the formulae:- $N = 1000S/\pi d$ $S = \pi dN/1000$		Know spindle revolution or cutting speed for specified size of drill using the formulae:- $N = 1000S/\pi d$ $S = \pi dN/1000$	Calculate spindle revolution or cutting speed for specified size of drill using the formulae:- $N = 1000S/\pi d$	

Where S = cutting speed(m/min)N =revolutions/minuteD = diameter of drill(mm) $\pi = 3.142$	Where S = cutting speed (m/min) N = revolutions/minute D = diameter of drill (mm) $\pi = 3.142$	Where S = cutting speed (m/min) N = revolutions/minute D = diameter of drill (mm) $\pi = 3.142$	$S = \pi dN/1000$ Where S = cutting speed (m/min) N = revolutions/minute D = diameter of drill (mm) $\pi = 3.142$	
 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. 3.10 Describe reaming operation 	Explain safety precautions to be observed when using a drilling machine. Explain reaming operation	Know safety precautions to be observed when using a drilling machine.	Observer safety precaution using PPE safe operation of drilling machine	
3.11 Explain the purpose of reaming	Explain the purpose of reaming	Know reaming activities	Perform reaming operations	

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

7 -9	4.1 Define thread	Explain thread	Diagrams Video player		Guide student to:	Samples of threads,
	 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. 	 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. 	Marker White Board Smart board Computer Internet Projector Textbooks Slides	Identify thread forms and their applications	Identify thread forms and their applications	Taps, Die & stock, Tap wrench, Rivets, Vernier caliper, Micromete r screw gauge, Steel rule, PPE,
	4.3 Define tap	Explain tap				
	 4.4. Describe the functions of: Taps (taper tap, second tap, plug) Tap wrench Die and die stock. 	 Explain the functions of: Taps (taper tap, second tap, plug) Tap wrench Die and die stock 		Identify the functions of:- • Taps (taper tap, second tap, plug) • Tap wrench • Die and die stock.	Perform tapping operations using tap as in 4.4	
	4.5 Explain tap size and estimate its value in given					

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

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

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

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

 Boring tool, etc. 6.11 Describe the effects of wrong cutting tools setting: e.g.: Vibration and shatten 	 Boring tool, etc Explain the effects of wrong setting cutting tools e.g.: Vibration and 			
 Vibration and chatter, Tool rubbing against or digging into the job. 6.12 Discuss the cutting speed and feed with 	 Vibration and chatter, Tool rubbing against or digging into the job. Explain the cutting speed 			
respect to lathe operation.	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 trained	e 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	s and limitations.				
3.0 Carryout storage of tools used for the repairs of agricultural equipt	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.					

MODUL	E: MATERIAL AND WORK	SHOP PROCESSES	COURSI	E CODE: CAM 122	CREDIT HOURS: 19 THEORETICAL:	2
YEAR: 1				QUISITE:	PRACTICAL:	
	This module is designed to provi	de the trainee with relevant kn	owledge of work	*		
	ETICAL CONTENT			PRACTICAL CONTENT		
	AL OBJECTIVE 1.0: Understand	· · ·				
WEEK	SPECIFIC LEARNING	TEACHERS	RESOURCE	SPECIFIC LEARNING	TEACHERS	RESOURCES
	OUTCOME	ACTIVITIES	S	OBJECTIVES	ACTIVITIES	
1-2	1.1 Define safety precaution	Explain safety precaution.	Marker/ chalk White Board/		Guide trainees to:	PPE
		Explain sources of hazards	black board			First Aid box
	1.2 List sources of hazards in	in the workshop as in 1.2	Textbooks	Identify sources of hazards	Recognize sources of	
	the workshop:		Projector	in the workshop	hazards in the	Bins
	• Obstructions left on the		Computer	L.	workshop	
	floor and benches		Internet		*	
	• Loose fitting clothing		Slides			
	Using inflammable or		Diagrams			
	corrosive liquid or gases		Charts			
	etc.	Explain first aid				
		applications in case of				
	1.3 Describe first aid	minor injuries, electric				
	applications in case of minor	shocks and burns.				
	injuries, electric shocks and					
	burns.					
	ourns.	Explain artificial				
		respiration.				
	1.4 Explain artificial	respiration.		Discuss artificial respiration	Demonstrate	
	^				artificial respiration	
	respiration				using dummy	

GENER	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	Explain the properties of	Marker	Know the properties of all	Guide trainees to:	Round		
	all types of metals used in	all types of metals used in	White Board	types of metals	Identify the properties of all	bar metal		
	agricultural equipment:	agricultural equipment:	Textbooks		types of metals			

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

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

5-6	3.1 Describe the use and	Explain the use and	Tools rack	Identify the various tools	Guide trainees to:	Tool Boxes
	maintenance of common	maintenance of common	Charts	used and their maintenance.	Recognize various tools	
	tools used for typical	tools used for typical repair	Marker		used for typical repairs	Steel Roll
	repair and maintenance	and maintenance work:	White Board			
	work:	• Spanners	Textbooks,			Calipers
	• Spanners	Screw driver	Projector			
	Screw driver	• Drills	Slides			Dividers
	• Drills	Reamers	Diagrams			~
	• Reamers	• Taps and dies	Charts			Square
	• Taps and dies	• Files				G(1)
	• Files	• Saws				Straight
	• Saws	Chisels				Edge
	• Chisels	• Taps and pinches.				Protractors,
	• Taps and pinches.			Know the importance of		Flottactors,
		Explain the importance of		care of measuring	Carryout cleaning and	Angle
	3.2 Describe the care of	care of measuring		instruments	storing of measuring	Gauge
	measuring instruments:	instruments:		instruments	instruments	Guuge
	• Steel roll	• Steel roll				Hydraulic
	Calipers	Calipers				Press
	• Dividers	• Dividers				
	• Square	• Square				Cranes
	• Straight edge	• Straight edge				
	Protractors	Protractors				PPE
	Angle gauge	Angle gauge				
	Thickness gauge	Thickness gauge				
	• Micro meter.	• Micro meter.				
				Identify the care of:		
		Explain the care of:		• Pullers	Perform care of:	
	3.3 Describe the care of:	Pullers		 Hydraulic press 	• Pullers	

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

7-9	4.1 Describe the use of	Explain the use of various	Charts		Guide trainees to:	Sheet
	various types of sheet	types of sheet metals:	Marker/ chalk			metals
	metals:	Brass sheets	White			Waste cloth
	Brass sheets	• Copper sheets	Board/blackb	Know use and care of		Hammers
	Copper sheets	• Aluminum sheets etc.	oard	various types of sheet metals		Mallet
	• Aluminum sheets etc.		Textbooks			Snipes
		Explain the use of sheet	Projector			Govers
	4.2 Describe the use of sheet	metal tools:	Slides	Identify use of sheet metal		Lappers
	metal tools:	• Mallet	Diagrams	tools	Identify use of sheet metal	Swages
	• Mallet	Snipes			tools	Riveting
	Snipes	• Grovers				Tools
	• Grovers	Lappers				Work
	• Lappers	• Swages				Bench PPE
	• Swages	• Hammer				TTL
	• Hammer	• Riveting tools etc.				
	• Riveting tools etc.					
		Explain the preparation of				
	4.3 Explain the preparation of	sheet metals for:		Identify sheet metals for:		
	sheet metals for:	Welding		Welding	Perform sheet metals	
	• Welding	Soldering		Soldering	Welding, Soldering and	
	Soldering	• Riveting, etc.		Riveting	Riveting	
	• Riveting, etc.	_		• Riveting	6	
		Explain the construction of				
	4.4 Describe the construction	simple items:		Know the construction of		
	of simple items:			simple items such as:		

 Guards and trays from Sheet materials. 	 Guards and trays from Sheet materials. 	GuardsTrays	Construct simple items such as: • Guards • Trays	
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GENER	AL OBJECTIVE 5.0: Understan	nd the principles of welding an	nd fabrications.			
10-12	5.1 Describe different types	Explain different types of	Charts		Guide trainees to:	Manual
	of soldering iron use in	soldering iron use in	Marker			arc
	mechanical and electrical	mechanical and electrical	White Board	Know the different types of	Identify the different types of	welding
	work:	work:	Textbooks	soldering iron.	soldering iron	machine,
	Electrical solders	 Electrical solders 	Projector			
	Brazing rods	 Brazing rods 	Slides		Carryout the setting up of	Electrodes,
	Welding rods	 Welding rods 	Diagrams		welding equipment.	AC, DC
	• Fluxes in common	Fluxes in common				welding
						machine,
				Identify the setting up of		Oxy-
	5.2 Describe the setup of	Explain the setup of		welding equipment.		acetylene
	welding equipment for	welding equipment for				, welding
	welds of different types of	• 1				cylinder
	metals:	metals:			Identify the basic principle of	and
	 Selecting gas 	 Selecting gas 			oxyacetylene welding	regulators
	pressure	pressure				Forging
	Nozzle sizes	 Nozzle sizes 		know the basic principle of	Carryout brazing for repair	tools,
				oxyacetylene welding	work and build worn parts.	Hammers
	5.3 Describe the basic	Explain the basic principle		oxyacetylene weiding	work and build worn parts.	Taimiers
	principle of oxyacetylene	of oxyacetylene welding				, PPE,
	welding			Know the use of bronze for	Perform cutting operation	Soldering
				brazing for repair work and	using oxy-acetylene flame	Iron
	5.4 Describe the use of bronze	Explain the use of bronze		build worn parts.		
	brazing for repair work	brazing for repair work		Contra norm parton		
	and build worn parts.	and build worn parts.		Know the use of oxy-		
				acetylene flame to cut metal.		

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

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

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 Mechaniza	tion
GENERAL OBJECTIVE: On completion of this module, the tr	rainee should be able to:	
1.0 Understand farm mechanization		
2.0 Know the uses of simple machines		
2.0 Know the uses of simple machines		

PROGR	PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE								
MODUI	E: INTRODUCTION TO AGR	ICULTURAL	COURSE CODE: CAM 123		NTACT HOURS: 120				
MECHANIZATION				THEORETICAL: 48 HOURS					
YEAR:			PRE: REQUISITE:		ACTICAL: 72 HOURS				
GOAL:	GOAL: This module is designed to provide the trainee with the knowledge and skills of agricultural Mechanization								
THEOR	ETICAL CONTENT			PRACTICAL CON	ΓENT				
GENER	AL OBJECTIVE 1.0: Understan	nd farm mechanization							
WEEK	SPECIFIC LEARNING OUTCOME	TEACHERS ACTIVITIES	RESOURCES	SPECIFIC LEARNI OBJECTIVES	ING 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. 	Explain the history of mechanized agriculture. Explain the advantages o mechanized agriculture Explain the problems fac mechanized agriculture in Nigeria Explain in simple terms the Federal Government Polition on mechanized agriculture	charts, Projector, n Computer, Internet, Textbooks, the Slides,						

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

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

		Slides			Disc plow
3.3 Describe the purpose of tillage	Explain the purpose of tillage				Chisel plow Cultivator
 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 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		Identify common tillage equipment	Recognize common tillage equipment	Harrow

GENER	AL OBJECTIVE 4.0: Know m	achinery for planting operations	S			
6	4.1 Define planting	Explain planting process	Marker		Guide trainees to:	Planters
			White board			DDE
			Charts			PPE
	4.2 Describe planting		Projector	Identify planting machine	Recognize planting	Seed metering
	machine	Explain planting machine	Computer		machine	components
			Internet			1
			Textbooks			Soil engaging
	4.3 Describe planter		Slides			components
	classification					

 Broadcasting Dibbling Drilling Seed drilling behind a plough Transplanting Hill dropping Checkrow planting 4.4 Describe planter component parts 4.5 Describe planter soilengaging 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 	Identify planter component parts Identify planter soil engaging componen Identify planter seed metering componen Identify planter seed delivery components	ntsRecognize planter soil- engaging componentsdRecognize planter seed metering componentsdRecognize Planter seed	Tools Box
delivery components	Explain planter seed delivery components			

5.1 Define farm management	Explain farm management	rinciples of farm m Marker		Guide trainees to:	
6		chalk			PPE
5.2 Describe principles and		White board			
functions of farm	Explain principles and	Blackboard			Farm tools box
management	functions of farm	Charts			
	management	Projector			
5.3 Describe common		Computer			
concepts and tools used	Explain common concepts	Internet	Identify common tools	Recognize common	
in farm management	and tools used in farm management	Textbooks Slides.	used in farm management	tools used in farm management	
5.4 Explain machine management					
_	Explain machine				
5.5 Describe key principles in machine management	management				
• Selection and matching	Explain key principles in				
• Maintenance and care	machine management:				
• Safe operation	• Selection and matching				
• Efficient operation	Maintenance and care				
• Economic considerations	Safe operation				
Record keeping	Efficient operation				
1 2	• Economic				
5.6 Describe machine	considerations				
management phases and levels	Record keeping				
• Planning	Explain machine				
• Scheduling	management phases and				
• Operating	levels				
1 0	Planning				
5.7 Describe common	• Scheduling				
preventive maintenance checks for :	• Operating				
• Winterizing equipment	Explain common preventive		Know common		
• Checking and changing	maintenance checks for :				
fluids	• Winterizing equipment		preventive maintenance checks		

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

MODULE: INTRODUCTION TO TRACTOR	SUBJECT CODE: CAM 131	CONTACT HOURS:
YEAR: 1 TERM: 3	PRE: REQUISITE:	THEORETICAL:
		PRACTICAL:
GOAL: This module is designed to introduce the trainee GENERAL OBJECTIVE: On completion of this module		
1.0 Understand source of power, classification of tractor		
1.0 Understand source of power, classification of tractor2.0 Understand the basic tractors components (engine syst	ems, power transmission, hydraulic systems, contr	ols and operation).

MODUL	E: INTRODUCTION TO TRA	CTOR SU	J BJECT CODE: CAN	4 131		T HOURS TICAL: 36 HOURS	
YEAR:	1 TERM: 3	PI	RE: REQUISITE:		PRACTIC	CAL: 48 HOURS	
THEOR	This module is designed to introd ETICAL CONTENT AL OBJECTIVE 1.0: Understand			PRACTICA	L CONTENT	[
WEEK	SPECIFIC LEARNING OUTCOME	TEACHERS ACTIVITIES	RESOURCES	SPECIFIC L OUTCOME	EARNING	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) 	 Explain the different source of farm power available which are classified as: Human power Animal power Mechanical power (Tractors + Power tillers Oil engines) Electrical power Renewable energy (Biog + Solar energy + Wind energy) 	 White Board, Black board, Chalk, Smart board, Computer, + Internet, Projector, Textbooks, 	Discuss the d sources of far		Guide trainees to: Observe the different sources of farm power	Tractor Power tiller
	1.2 Define farm tractor	Explain tractor, its definition					
	1.3 Discuss the history of farm tractor	Explain the features of a tractor					

	1	1	1	
1.4 Describe the features of a				
tractor	Explain classification of			
	farm tractors base on size,			
1.5 Describe classification of	power and application			
farm tractors base on size,	Wheel tractor			
power and application	Crawler tractor			
• Wheel tractor	 Walking tractor 			
Crawler tractor	• Walking tractor			
Walking tractor	Englain ann and ann an af			
1 (D	Explain general purpose of			
1.6 Describe general purpose	row crop and special tractor			
of row crop and special				
tractors	Explain selection of farm			
	tractor depending on:			
1.7 Describe selection of farm	Land holding			
tractor depending on:	Cropping pattern			
Land holding	Soil condition			
 Cropping pattern 	Climate condition			
 Soil condition 	Repairing facilities			
Climate condition	Running cost			
Repairing facilities	• Resale value etc.			
Running cost				
• Resale value etc.				
	Explain a power tiller			
1.8 Describe a power tiller				
	Explain components of			
1.9 Describe components of	power tiller its operation and			
power tiller its operation	power transmission			
and power transmission	r - ····· ·····························			

GENE	RAL OBJECTIVE 2.0: Understa	and the basic tractors component	ents (engine systems, pov	wer transmission, hydraulic sys	tems, controls and operation).	
5-7	2.1. Describe tractor main	Explain tractor main	Marker		Tracto	tor
	components e.g.:	components e.g.:	Chalk			
	• Engine	• Engine	blackboard		Powe	er
	• Clutch	• Clutch	White Board		tiller	•

T	т. · ·	Current heard		
Transmission	Transmission	Smart board Textbooks		Power
• Differential	• Differential	Slides		Take-
• Final drive	• Final drive	Diagrams		Off
• Rear wheel	• Rear wheel	Computer		(PTO)
Steering mechanism	• Steering mechanism	Projector		(110)
Hydraulic	Hydraulic	Internet		Engine
• Brakes etc.	• Brakes etc.	Charts		model
		Video player		model
2.2 Describe the tractor engine	Explain the tractor engine	, nuco piujor		
system:	system:			
• Diesel engine principle	• Diesel engine principle			
• Engine components:	• Engine components:			
cylinders, pistons,	cylinders, pistons,			
camshafts, valves, fuel	camshafts, valves, fuel			
injection system etc.	injection system etc.			
2.3 Describe the tractor	Explain the tractor			
transmission system:	transmission system:			
Gear selection and shifting	• Gear selection and			
operation	shifting operation			
Clutch mechanism and	• Clutch mechanism and			
proper engagement	proper engagement			
• Power take-off(PTO)	• Power take-off(PTO)			
operation and attaching	operation and attaching			
implements	implements			
Transmission	Transmission types			
types(manual, power shift,				
•	Explain tractors tyres and front			
5	axle			
front axle				

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

3.2 Desc	ribe hitching system of	Explain hitching system of	Textbooks	impleme
tract	tor drawn implements	tractor drawn implements:	Slides	nt
• Tra	iled type implement	• Trailed type implement	Diagrams	
• Sen	ni-mounted type	Semi-mounted type	Computer	Semi-
imp	plement	implement	Projector	mounted
• Mo	ounted type implement	Mounted type	Internet	type
		implement.	Charts	impleme
			Video player	nt
3.3 Desc	ribe the following:	Explain the following:		
•	Wheel base	Wheel base		Mounted
•	Ground clearance	Ground clearance		type
•	Track	Track		impleme
•	Turning space	Turning space		nt
•	Cage wheel	Cage wheel		Tractor

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

MODULE: GENERAL METAL WORK II	SUBJECT CODE: CAM 132	CONTACT HOURS:
TERM: 3 TERM: 3	PRE: REQUISITE: CAM 121	THEORETICAL:
		PRACTICAL:
DAL: This module is designed to introduce to the tra	inee with knowledge and skills of general metal work	
GENERAL OBJECTIVE: On completion of this modu	le, the trainee should be able to:	
.0 Understand the basic principles of heat treatment of n	netal in the workshop.	
.0 Know how to produce simple engineering componen	ts by forging.	

PROGRA	AMME: NATIONAL TECHNI	ICAL CERTIFICATE IN	ENGINEERING (CRAFT PRACTICE				
MODUL	E: GENERAL METAL WORK	II	COURSE CODE: CAM 132		CONTACT HOURS: 60			
						EORETICAL:		
YEAR: 2				PRE: REQUISITE: CME 11 PRACTICAL:				
-	This module is designed to introdu	ice to the trainee with know	ledge and skills of g					
	cal Content			Practical Content				
	AL OBJECTIVE 1.0: Understand	<u> </u>						
WEEK	SPECIFIC LEARNING	TEACHERS	RESOURCES	SPECIFIC LEARNIN	NG	TEACHERS	RESOURCES	
	OUTCOME	ACTIVITIES		OBJECTIVES		ACTIVITIES		
1-4	1.1 Explain the structural	Explain briefly the	Text books	T 1 1 1		Guide trainees to:	Furnace	
	behaviour of plain carbon	structural behaviour of	Slides	Know the structural		Identify the structural	F (
	steel as it is heated from room	plain carbon steel as it is heated from room	Video Player Smart Board	behaviour of plain carbo		behaviour of plain carbon steel as it is heated from	Forge tongs	
	temperature to about 1000°C for the purposes of:		White Board	steel as it is heated from			PPE	
		temperature to about 1000°C for the purposes	Blackboard	room temperature to ab 1000°C	oui	room temperature to about 1000°C	PPE	
	Hardening Tempering	of:	Marker	1000 C		1000 C	Pliers	
	Tempering	Hardening	Chalk				1 11015	
	Annealing Normaliaina	Tempering	Computer					
	Normalising Case Herdening	Annealing	Projector					
	• Case-Hardening.	Normalising	Internet					
	1.2 Explain hardening metal	Case-Hardening.						
	work.	• Case-Hardening.						
		Explain hardening metal		Demonstrate hardening		Demonstrate hardening		
	1.3 Outline safety precautions	work.		metal work.		metal work.		
	relating to heat treatment			Vnow afoty mocrytics		Communit and fata		
	processes apply them in	Explain safety		Know safety precaution relating to heat treatme		Carryout safety precautions relating to		
	given situations.	precautions relating to		processes and apply th		heat treatment processes		
		heat treatment processes		in a given situations		and apply them in a given		
		apply them in given situations		in a given situations		situations		
		situations						

GENERAL OBJECTIVE 2.0: Know how to produce simple engineering components by forging.								
5-8	2.1 Describe with outline sketch	Explain with sketch the	Text books	Identify the main features	Guide trainees to:	Anvil		
	the main features and	main features and working	Slides	and working principles of				
	working principles of the	principles of the black	Video Player	the black smith's forge.	Identify the main features and	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.). 	 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) 	Smart Board White Board Marker Computer Projector Internet Diagrams	Identify the functions of common forging tools	working principles of the black smith's forge. Demonstrate forging using common forging tools	Leg vice Forging Hammers Hot set Cold set Sets of hammer Punchers Drifts
 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. 	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		Select appropriate forging tools for forging operations given engineering components	carryout forging operations in a given engineering components using appropriate forging tools	Fillers Top swage Bottom swage Flatter Open tongs Hallow bit

9-12 3.1 Describe basic principles and Explain basic principles Text books	Guide trainees to: Electric Arc
application of gas and metal arc welding.and application of gas and metal arc welding.Slides Video Play Smart Boa3.2 State the safety precautions to be observed and apply them in given welding situations.Explain the safety precautions to be observed and apply them in given welding situations.White Boa Marker3.3 Differentiate between gas welding Arc welding : Gas welding • Block pipes • Nucleus • Spack lighter • Blow pipesIdentify differences Arc and gas weldingDiagrams• Cliams • Cables • AC/DC welder• Cliams • AC/DC welder• Neter • Blow • AC/DC welder• Neter • Blow • Ac/DC welder• And application of gas and metal arc welding.• Slides • Nucleus • Ac/DC welder• And application of gas and metal arc welding.• Slides • Nucleus • Ac/DC welder• And application of gas and metal arc welding.• Slides • Nucleus • Ac/DC welder• And apply • Ac/DC welder• And apply<	rd arc welding. arc welding. Oxy-

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

MODULE: ALTERNATIVE ENERGY MECHANIZATION	SUBJECT CODE: CAM 211	CONTACT HOURS:
YEAR: 2 TERM: 1	PRE: REQUISITE:	THEORETICAL:
		PRACTICAL:
GOAL: This module is aimed at providing trainee with knowledge at	nd skills in the maintenance and troubleshoot	ing of alternative energy equipment.
GENERAL OBJECTIVE: On completion of this module, the trainee	should be able to:	
GENERAL OBJECTIVE: On completion of this module, the trainee	should be able to:	
	should be able to:	
	should be able to:	
1.0 Understand Photovoltaic (PV) systems and perform maintenance		7
1.0 Understand Photovoltaic (PV) systems and perform maintenance2.0 Know the skills to maintain and troubleshoot inverters and associat	ted electrical components of the PV assembly	7
1.0 Understand Photovoltaic (PV) systems and perform maintenance	ted electrical components of the PV assembly	7
1.0 Understand Photovoltaic (PV) systems and perform maintenance2.0 Know the skills to maintain and troubleshoot inverters and associat	ted electrical components of the PV assembly	,

PROGR	AMME: NTC IN AGRICULTU	RAL EQUIPMENT AND IM	PLEMENT MECI	HANIC WORK CRAFT	PRACTICE			
MODUL	E: ALTERNATIVE ENERGY M	ECHANIZATION	COURSE CODI	E: CAM 211	CONTACT HOURS:			
					THEORETICAL:			
YEAR: 2			PRE: REQUISI		PRACTICAL:			
	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 CENERAL OR ECTIVE 1.0: Understand Photovaltaia (PV) systems and perform maintenance maintenance								
	GENERAL OBJECTIVE 1.0: Understand Photovoltaic (PV) systems and p WEEK SPECIFIC LEARNING TEACHERS							
WEEK	OUTCOME	ACTIVITIES	RESOURCES	LEARNING	TEACHERS ACTIVITIES	RESOURCES		
	OUTCOME	ACTIVITIES		OBJECTIVES	ACTIVITIES			
1-2	1.1 Define Photovoltaic (PV)	Explain PV system	Charts		Guide trainees to:	Solar PV panel		
	systems	1 5	White Board					
			Blackboard			Controller		
	1.2 Explain the function of PV	Explain functions of PV	Chalk			Inverter		
	modules and arrays.	modules and arrays.	Slides					
			Drawings			Cables		
	1.3 Explain the construction of	Explain the construction of	Projector			Non-abrasive		
	PV modules and arrays.	PV modules and arrays.	Computer					
			Internet Markers			Hand tools		
	1.4 Explain types of PV arrays:	Explain types of PV arrays:	Multimedia			Cleaning agent		
	 Series 	• Series	Willineula					
	Parallel	 Parallel Combination				Multi meters		
	Combination	• Combination Explain components of the			Identify components of	Solar PV		
	Comonitation	PV system:			PV system	technical		
	1.5 Discuss the components of a	 PV solar panel 		Know components of	5	manual		
	PV system:	 I v solar paner Controller		PV system		F1 (1 (1		
	• PV solar panel	Breakers				Electrical tool		
	• Controller	DC cables				box		
	• Breakers	Inverter, etc.			Rectify defects in PV			
	• DC cables				system			
	• Inverter, etc.	Explain functions of the						
		components						
	1.6 Discuss the functions of the	L.						
	components							

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

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

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

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

3.5 Discuss the aerodynamic principles of wind turbine blades.	Explain the aerodynamic principles of wind turbine blades.			Visit an existing wind turbine facility
 3.6 Discuss structural issues encountered in wind turbine system such as: Erosion Cracks Delamination. 	 Explain structural issues encountered in wind turbine system such as: Erosion Cracks Delamination 	ins on wit	entify minor routine spections and repairs a turbine system in line ith national safety andards.	Perform minor routine inspections and repairs on turbine system in line with national safety standardss
3.7 Explain the integration of electrical components and control systems within wind turbines.	Explain the integration of electrical components and control systems within wind turbines.	Kn	now common faults in	
3.8 Explain common faults in control systems such as sensor failures and wiring issues	Explain common faults in control systems such as sensor failures and wiring issues	ser win	ntrol systems such as nsor failures and iring issues xplain routine	Rectify 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 routine inspections and minor repairs on components in line with national safety standards such as: • Motor • Generator • Blade	ins rep in saf	spections and minor pairs on components line with national fety standards such as 3.9	Carry out routine inspections and minor repairs on components in line with national safety standards

GENE	RAL OBJECTIVE 4.0: Understand	Solar Thermal System Mainten	ance			
	4.1 Define Solar thermal	Explain Solar thermal	Charts	Identify solar thermal	Guide trainees to:	Solar
	collectors	collectors	White Board	collectors	recognize solar thermal	thermal
			Slides		collectors	Assembly

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

fi 5.5 D b 5.6 D b 5.6 D 5.7 D	Discuss maintenance needs For types of batteries Discuss documentation of pattery performance e.g.: Voltages Current Discuss common issues with pattery management such as: Capacity degradation Thermal runaway Electrical faults.	 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
Cour	sework	A Course Test 30%	SSESSMENT CRI Practical 40%	TERIA Other: Examination/Proje	ect 30%	

PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE **MODULE:** IMPLEMENTS AND MACHINES I **SUBJECT CODE:** CAM 212 **CONTACT HOURS:** YEAR: **TERM:** 1 **THEORETICAL:** 2 **PRE: REQUISITE**: **PRACTICAL: GOAL:** This module is designed to provide the trainee with the knowledge to identify and perform routine maintenance of different farm implements and machines. 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

PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND MODULE: IMPLEMENT AND MACHINE 1			COURSE CODE: CAM 212		CREDIT HOURS: THEORETICAL:		
YEAR: 2	TER	PRE REQUISITE:			PRACTICAL:		
GOAL: Thi	is module is designed to provide	the trainee with the know	ledge and skills to id	entify and perform	routine ma	intenance	
	ICAL CONTENT			PRACTICA	L CONTE	INT	
	OBJECTIVE: 1.0: Know routi	0	1	T		1	1
WEEK	SPECIFIC LEARNING OUTCOME	TEACHERS ACTIVITIES	RESOURCES	SPECIFIC LEA OBJECTIVES	ARNING	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 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 	 Explain the various types of harrows and ploughs arrangement: Single row Multiple row V-arrangement (off-set arrangement) Tandem 	Identify the various types of harrow and plough arrangement.	Recognize the various types of harrow and ploughs arrangement	
 1.8 Describe the various parts of harrow and plough e.g.: Disc-shaft Flashers Dash bars 	 Explain the various parts of harrow and plough e.g.: Disc-shaft Flashers Dash bars Tool bars 	Identify the various parts of harrow and plough	Recognize the various types of harrow and plough arrangement.	
 Tool bars Arrangement 1.9 Explain the removal and installation of worn out or damaged disc or blades on ploughs, harrows, rotovators and ridgers. 	• Arrangement Explain the removal and installation of worn out or damaged disc or blades on ploughs, harrows, rotovators and ridgers.	Know the process of removal and installations of worn out or damaged disc or blades on ploughs, harrows, rotovators and ridgers.	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			Marker		Guide trainees to;	Seed Planters		
			White Board					
	2.1 Describe working	Explain the working	Textbooks	Identify different types of	Identify planting	Combine Drill		
	principles of planting	principles of planting	Projector	planting equipment	equipment			
	equipment	equipment	Computer					
			Internet			Root crop planter		
			Slides					

2.2 Describe different types	Explain different	Diagrams			Hand planters
of planting equipment e.g.: • Hand drill • Seed drill • Combine drill • Seed planters • Root crop planting equipment	 types of planting equipment e.g.: Hand drill Seed drill Combine drill Seed planters Root crop planting equipment 	Charts		Course out ootting	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 Carryout	
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	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		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 above2.7 Explain the removal and replacement of damaged parts in 2.5 above	• Delivering unit 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 man	nure spreaders		
6-8			Marker Chalk White Board		Guide trainees to:	Farm Tool Box Fertilizer
	3.1 Explain the principles of fertilizer application and	Explain the principles of fertilizer applicators	Blackboard Projector	Identify different types fertilizer applicators and		applicator
	manure spreaders	and manure spreaders	Computer Internet	manure spreaders		Manure spreader
	3.2 Describe different types of	Explain different types of fertilizer and manure	Slides Diagrams			
	fertilizer applicators and manure spreaders	applicator	Charts Textbooks			
	3.3 Describe the maintenance of both fertilizer applicators and manure spreaders	Explain the maintenance of both fertilizer applicators and manure spreaders		Identify maintenance requirement on both fertilizer applicators and manure spreaders	Carryout maintenance on both fertilizer applicators and manure spreaders	
	3.4 Describe the calibration of application rate for fertilizer applicator	Explain the calibrating of application rate for fertilizer applicator		Identify calibration rate for fertilizer applicators	Calibrate fertilizer applicator	
	15 Decile de constitue of	Explain the operation with fertilizer applicator		V	Operate fertilizer	
	1.5 Describe the operation of fertilizer applicators and manure spreaders	and manure spreader Explain the dismantling,		Know operations of fertilizer applicators and manure spreaders	applicators and manure spreaders	
	manure spreaders	assembly, replacement		inaliare spreaders	Dismantle, repair,	

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	

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

<u>0EREKAL</u> 11-12	OBJECTIVE 5.0: Know routine	maintenance of spraying a	Marker		Guide trainees to:	Boom Sprayer
11 12	5.1 Discuss the working	Explain the working	Slides	Identify maintenance	Carryout	Boom Spidyer
	principle of spraying and	principle of spraying and		needs for spraying and	maintenance	Knapsack Sprayer
	dusting equipment	dusting	White Board	dusting equipment	spraying and	
	8 1 1	Equipment	Projector	811	dusting	Manure Spreader
		1 1	Computer		equipment	1
	5.2 Describe the maintenance	Explain the maintenance			1 1	Duster
	of spraying and dusting	of spraying and dusting	Charts			
	equipment	equipment	Textbooks			
	5.3 Describe the calibration of	Explain the calibration				
	application rate for	for spraying and		Know calibration of	Carryout	
	spraying and dusting chemicals	dusting equipment		spraying and dusting equipment	calibration of spraying and	
		Explain the operation of			dusting equipment	
	5.4 Describe the operation of	spraying and dusting				
	spraying and dusting	equipment.		Know spraying and	Operate spraying	
	equipment			dusting equipment	and dusting	
		Explain the			equipment	
	5.5 Describe the dismantling,	dismantling, assembly,				
	assembly, replacement or	repair of damaged or			Dismantle,	
	repair of damaged or	replacement of worn		Identify repairs of spraying	assemble, replace	
	worn out parts	out parts		and dusting equipment	damaged or repair	
					worn out parts	
	ASSESSMENT CRITERIA					
	Coursework	Course Test 20%	Practical 60%	Other: Examination/Project	20%	

	PROGRAMME:	NTC IN AGRICULTU	RAL EQUIPMENT AND	IMPLEME	NT MECHANIC WOR	K CRAFT PRAC	ГІСЕ	
	MODULE: MAC	HINING OPERATIONS	5	COURSE C	CODE: CAM 213	CONTACT HOURS: THEORETICAL: PRACTICAL: utting and shaping operation. TEACHERS ACTIVITIES TEACHERS ACTIVITIES RESOURCES Guide trainees to: Workshop Tool Box Identify the tools and machines for metal shaping operations. Lathe machine Power saw Identify tools use in metal shaping operation Drilling machine Use machines to carry out metal General Hand Tools		
	YEAR: 2	TERM:			UISITE: CAM 112			
			the trainee with the knowled	lge and skills				
	THEORETICAL C				PRACTICAL CONTR	ENT		
			ools and machines use in met	1 0 1				
WEEK	SPECIFIC LEARNING	TEACHERS	RESC	OURCES	SPECIFIC		RESOURCES	
	OUTCOME	ACTIVITIES			LEARNING	ACTIVITIES		
					OBJECTIVES			
1-3	1.1 Define metal shaping	Explain metal	Marke				Workshop Tool Box	
	operations	shaping operations	Slides		Identify tools and	2		
	1.2 List the machines use	Explain the	Diagra		machines for metal		Lathe machine	
	in metal shaping	machines use in		e Board	shaping operations.			
	operations: e.g.:	metal shaping	Projec			1 0	Grinding machine	
	Lathe	operations e.g.:	Comp			operations.	D	
	Grinding machine	• Lathe	Intern		Identify tools use in	Idontify to ala	Power saw	
	Power sawing	Grinding	Textb		Identify tools use in metal shaping	2	Drilling machine	
	• Tower sawing machine	machine	Texto	JOOKS	operation		Diffining machine	
	Drilling machine	Power			operation	1 0	Milling machines	
	 Milling machine. 	sawing				operation	winning indefinites	
	• Winning machine.	machine				Use machines to	General Hand Tools	
		Drilling			Use machines to carry	carry out metal		
		machine			out metal shaping and			
		Milling			cutting operation.	cutting	1 /	
		machine				operation.	,	
	1.3 List the tools use in	Explain the tools use				Use hand teels		
	metal shaping	in metal shaping			Use hand tools to			
	operation e.g.:	operation e.g.:			carry out cutting and	cutting and		
	Files hacksaw	• Files			shaping of metals.	shaping of		
	• Punches	• Files hacksaw				metals.		
	• Hand drills etc.					metalo.		
		Punches						
		Hand drills						

	etc.		
1.4 Understand the operations of tools and machines used in metal shaping.	Explain the operations of tools and machines used in metal shaping.	Carry out shap lathe and millin machines	
 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 	Discuss the operations of machines for metal shaping operations Explain the use of tools and machines for simple machine shaping operation	Use tools to ca simple machine shaping operat	e operation

	GENERAL OBJEC	CTIVE 2.0: Know the p	rinciples of metal shaping operations	5		
4-8	2.1 Understand metal	Explain metal	Marker		Guide trainees to:	Marking Tools:
	cutting Operation	cutting	Slides	Use common hand	Use common	(Steel rule, Calliper,
		Operation.	Diagrams	tools to cut metals	hand tools to cut	'V' Block, Scriber,
	2.2 Understand the	Explain the	White Board		metals	Surface Plate, Surface
	principle of metal	principle of	Projector			Gauge, Angle Plate)
	shaping and chip	metal shaping	Computer	Operate metal shaping	Operate metal	
	formation.	and chip	Internet	machine	shaping machine	Files hacksaw
		formation	Charts			
			Textbooks		Plan for a	Punches
	2,3 Understand how to	Explain how to plan		Plan for a shaping	shaping	
	plan for a shaping	for a shaping		operation.	operation.	Hand drills
	operation	operation		_	_	
	_				Operate the	Chisel
					lathe and other	

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

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

3.1 Define lathe machine	Explain lathe machine	Marker Slides	Identify the essential	Guide trainees to: Identify the	Point tools
3.2 Describe the essential	Explain the essential	Diagrams White Board	features of a centre lathe	essential features of a	Grinding machine
features of a centre	features of a centre	Projector	lattie	centre lathe	Lathe machine
lathe: • Lathe bed • Headstock • Tailstock • Saddle or carriage, etc.	lathe: • Lathe bed • Headstock • Tailstock • Saddle or carriage	Computer Internet Charts Textbooks	Identify the working	Identify the working principles of the centre lathe	3-jaw chuck and lath machine and accessories Catch plate
elc.	carriage, etc.		principles of the centre lathe	T • 4	Face plate
				List the functions of	Dog lathe

3.3 Describe the working	Explain the working	List the functions of	centre lathe	
principles of the centre	principles of the	centre lathe	accessories	Lathe centers
lathe.	centre lathe	accessories		
				Fixed steadies
3.4 Describe the functions	Explain the			
of centre lathe	functions of centre			Travelling
accessories:	lathe			steadies
• Catch or driving	accessories:			
plate	• Catch or			Round nose turning
• Face plate	driving plate			tool
• Lathe dog or carrier	• Face plate			
• Lathe centres	• Lathe dog or			Fine finishing tool
• Fixed and travelling	carrier			
steadies.	• Lathe centres			Form tool
	• Fixed and			
	travelling			Parting off tool
3.5 Describe the differences	steadies.			Boring tool
between the centre				Bornig tool
lathe, and capstan	Explain the			Bar of good length
lathe	differences between			Dai of good length
	the centre lathe, and		Identify cutting	Live/dead centers
	capstan lathe		fluids use for	
			lathe turning	Site finishing
3.6 Describe types of	Explain types of	Identify types of	6	6
cutting fluids use for	cutting fluids use for	cutting fluids use for	Identify safety	Knife tools
lathe turning.	lathe turning	lathe turning.	precautions to	
intile turning.		_	be observed	
3.7 Describe safety	Explain safety	Identify safety	when working	
precautions to be	precautions to be	precautions to be	on the lathe	
observed when	observed when	observed when		
working on the lathe	working on the lathe	working on the lathe		
_			Draw and label	
			common tools:	
		Draw and label	• Butt-brazed	
3.8 Describe with sketch	Explain with sketch	common tools:	tool	
common tools:	common tools:	common toors.	• Tipped tool	

 Butt-brazed tool Butt-brazed tool Bit and holder. Tipped tool Tipped tool Bit and holder. Tipped tool Bit and holder. Tipped tool Bit and holder. Stand holder. Stand holder. Stand holder. Stand holder. Stand holder. Stand holder. Tipped tool Bit and holder. Tipped tool Tipped tool Tipped tool Tow and label tool angles (rake, clearance) Tow and state their uses e.g.: Round nose rougher Fine finishing Side finishing Boring tool, etc.<		1 1		
 Bit and holder. Tipped tool Bit and holder. Tipped tool Bit and holder. Bit and hol	Butt-brazed tool	Butt-brazed	• Butt-brazed	• Bit and
3.9 Describe with sketches tool angles (rake, clearance) stating their values for different metals to be machined.Explain with sketches tool angles (rake, clearance) stating their values for different metals to be machined.Draw and label tool angles (rake, clearance)Draw and label tool angles (rake, clearance)3.10 Differentiate between various tool shapes and state their uses e.g.:Explain various tool shapes and state their uses e.g.:Identify tool shapes and state their uses e.g.:Identify tool shapes and state their uses e.g.:• Round nose rougher • Fine finishing • Side finishing • Side finishing • Side finishing • Fine finishing • Side finishing • Side finishing • Side finishing • Side finishing • Side finishing • Side finishing • Fine finishing • Side finishing • Side finishing • Fine finishing • Side finishing • Side finishing • Side finishing • Fine finishing • Side finishing • Side finishing • Side finishing • Side finishing • Side finishing • Side finishing • Fine finishing • Side finishi	Tipped tool	tool	tool	holder.
3.9 Describe with sketches tool angles (rake, clearance) stating their values for different metals to be machined.Explain with sketches tool angles (rake, clearance) stating their values for different metals to be machined.Draw and label tool angles (rake, clearance)Draw and label tool angles (rake, clearance)3.10 Differentiate between various tool shapes and state their uses e.g.: • Round nose rougher • Side finishing • Side • Finishing • Side finishing • Side finishing • Side • Finishing • Side finishing • Side • Side • Finishing • Side <b< td=""><td></td><td>• Tipped tool</td><td>• Tipped tool</td><td></td></b<>		• Tipped tool	• Tipped tool	
10holder.holder.holder.holder.praw and label tool angles (rake, clearance) stating their values for different metals to be machined.Explain with sketches tool angles (rake, clearance) stating their values for different metals to be machined.Explain with sketches tool angles (rake, clearance)Draw and label tool angles (rake, clearance)Draw and label tool angles (rake, clearance)3.10 Differentiate between various tool shapes and state their uses e.g.: • Round nose rougher • Fine finishing • Side • Fine finishing • Side • Fine finishing • Side • Form tool • Parting off tool • Parting off tool • Boring tool, etc.Knife tool • Parting off tool • Boring tool, etc.Identify with sketches the effects of wrong setting cutting tools: c.g.: • Notion and state • Notion tool • Parting off tool • Boring tool, etc.Identify with sketches the effects of wrong setting cutting tools: c.g.:Identify with sketches the effects of wrong setting cutting tools: c.g.:				
3.9 Describe with sketches tool angles (rake, clearance) stating their values for different metals to be machined.Explain with sketches tool angles (rake, clearance) stating their values for different metals to be machined.Draw and label tool angles (rake, clearance) (rake, clearance)3.10 Differentiate between various tool shapes and state their uses e.g.: • Round nose rougherExplain various tool shapes and state their uses e.g.: • Round nose rougherIdentify tool shapes and state their uses e.g.: • Round nose rougher • Fine finishing • Side finishing • Side finishing • Side finishing • Side finishing • Side finishing • Form tool • Parting off tool • Boring tool, etc.Identify with sketches the effects of wrong setting cutting tools: • Wrong setting • Vibraion andIdentify with sketches the effects of wrong setting cutting tools: • Vibraion andIdentify with sketches the effects of wrong setting cutting tools: • Vibraion and				
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the effects of wrong setting cutting tools:cutting tools: e.g.:Identify with sketchestools• Vibration and• Vibration andsetting cutting tools	3.11 Describe with sketches			
setting cutting tools: • Vibration and setting cutting tools				tools
Setting culture tools		<u> </u>		
e a ' chatter		• vibration and chatter	setting cutting tools	
e.g.: chatter	0.g	Chauth		

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

		Draw the main features of bench or pillar drilling machine	or pillar drilling machine	Center drill Taps
4.4 Describe drill bit	Explain drill bit			Tap wrench
 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 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	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: • 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 • Countersink drill • Counter bore drill • Counter bore drill • Combination centre drill.	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	a ground twist drill		Identify the effects of	following faults	
the following faults in a	bit:	f	following faults in a:	in a:	
ground twist drill bit:	• Point angle	•	Ground twist drill	 Ground twist 	
Point angle too	too acute;	•	Point angle too	drill	
acute;	• Point angle		acute	• Point angle	
Point angle too	too obtuse;	•	Point angle too	too acute	
obtuse;	Cutting		obtuse etc.	• Point angle	
Cutting edges	edges at			too obtuse	
at unequal	unequal			etc.	
angles	angles				
Insufficient lip	 Insufficient 				
clearance	lip clearance				
Excessive lip	Excessive				
clearance.					
clearance.	lip clearance.				
	clearance.		Calculate spindle		
4.7 Explain spindle	Explain spindle		revolution or cutting	Calculate	
revolution or cutting	revolution or cutting		speed for a specified	spindle	
speed for a specified	speed for a specified		size of drill.	revolution or	
size of drill using the	size of drill using			cutting speed for	
formulae:-	the formulae:			a specified size	
$N = 1000S/\pi d$	$N = 1000S/\pi d$			of drill.	
	$S = \frac{1000S}{\pi a}$			or driff.	
$S = \frac{\pi dN}{1000}$					
Williams Consertitions	πdN/1000				
Where $S = cutting$	Where S =				
speed (m/min) N =					
	cutting speed				
revolutions/minute	(m/min) N =				
D = diameter of					
drill (mm)	revolutions/min				
$\pi = 3.142$	ute D =				
	D = diameter of				
	drill (mm)				
	$\pi = 3.142$				
4.9 E	Enulain the second				
4.8 Explain the causes of	Explain the causes				
drilling faults such as:-	of drilling faults				
Drill breaking;	such as:-				

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

	GENERAL OBJEC	CTIVE 5.0: Know the car	re and maintenance of machine tools an	d 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	1.2 Describe the care and maintenance of machine tools	Explain the maintenance of machine tools.		m m	Carry out repairs and naintenance of lathe nachine and other nachines	Carry out repairs and maintenance of lathe machine and other machines Carry out
1	.3 Describe the care and maintenance of shaping machine	Explain the maintenance of lathe machine and other machines.		m m	arry out	maintenance of lathe machine and other machines
	ASSESSM	IENT CRITERIA		•		· · ·
	Coursework	Course Test 20%	Practi	ical 60% O	Other: Examination/Pro	ject 20%

PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND	IMPLEMENT MECHANIC WORK	CRAFT PRACTICE
MODULE: TRACTOR AND ITS COMPONENTS	SUBJECT CODE: CAM 221	CONTACT HOURS:
YEAR: 2 TERM: 2	PRE: REQUISITE: CAM 131	THEORETICAL:
		PRACTICAL:
GOAL: This module is aimed at providing trainee with knowledge at GENERAL OBJECTIVE: On completion of this module, the trainee		and subsystems of the tractor
1.0 Understand Tractor Layout		
2.0 Understand Tractor Fundamental Components and Subsystems		
3.0 Understand Cab, Tractor Controls. Instrumentation, Operator Interf	ace Layout and safety requirement	
4.0 Know Tractor Starting and Stopping Procedures		
5.0 Know implement and cab mounting correctly to the tractor		

PROGR	AMME: NTC AND ANTC I	N AGRICULTURAL EQ	UIPMENT A	AND I	MPLEMENT MECHANIC	WORK C	RAFT PRA	СТІСЕ
MODUL	E TRACTOR AND ITS COMP	ONENTS	(COUI	RSE CODE: CAM 221		CONTACT	
							THEORET	TICAL:
YEAR:	2 TERM				REQUISITE: CAM 131		PRACTICA	
GOAL: '	This module is aimed at providi	ng trainee with knowledge	and skills to u	unders	tand tractor layout and fundar	nental cor	nponents and	l subsystems of the
	tractor	-					-	-
THEOR	ETICAL CONTENT			ł	PRACTICAL CONTENT			
GENERA	AL OBJECTIVE 1.0: Understa	nd Tractor Layout						
WEEK	SPECIFIC LEARNING	TEACHERS	RESOURC	ES	SPECIFIC LEARNING	TEACH	ERS	RESOURCES
	OUTCOME	ACTIVITIES			OBJECTIVES	ACTIVI	TIES	
1-2	1.1 Define tractor layout and	Explain tractor layout	Charts			Guide tra	inees to:	Tractor
	its key elements	and its key elements	White Board	d		Identify	tractor	
	5	5	Slides		Identify tractor layout and		nd its key	
			Drawings		its key elements.	element	•	
			Projector		Identify the			
	1.2 Discuss impact of layout	Explain impact of	Markers		interrelationship between	Identify t		
	on tractor performance.	layout on tractor	Multimedia		various subsystems within a	interrelat		
		performance.	Computer			between	various	
			Projector		tractor.	subsystem	ms within a	
	1.3 Recognize the		Digital			tractor.		
	e	E	schematics					
	importance of a well-	Explain the importance	System		Compare legacy designs	G		
	designed layout in	of a well-designed	flowcharts		with current layout trends.	Compar	0,	
	overall machinery	layout in overall	nowchants			designs		
	functionality	machinery functionality				current	layout	
	1.4 Trace the evolution of	Evaluin the evalution of				trends.		
		Explain the evolution of			Draw and label a diagram			
	tractor design and layout	tractor design and			of a tractor with			
	over time.	layout over time.				Draw and	d label a	
					component names.		of a tractor	
						with com		
						names.	-P SHOW	
						numes.		
	1.5 Explain key milestones	Explain key milestones						
	that have influenced	that have influenced						
	modern tractor	modern tractor						

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

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

		1 1 4		
	transmission layout on power delivery and	power delivery and balance	Evaluate design choices that affect powertrain	Evaluate design choices that affect
	balance	balance	efficiency and maintenance	powertrain
		Explain the layout of	access.	efficiency and
2.	.5 Understand the layout of	hydraulic circuits and		maintenance access.
2.	 hydraulic circuits and components in a tractor. 6 Discuss how hydraulic design supports various functions like lifting, steering, and attachments. 	components in a tractor. Explain how hydraulic design supports various functions like lifting, steering, and attachments. Explain the design and	Identify hydraulic components and their positions within the tractor layout. Identify the routing and integration of hydraulic lines and reservoirs.	Identify hydraulic components and their positions within the tractor layout. Identify the routing and integration of hydraulic lines and reservoirs.
2.	7 Know the design and distribution of electrical components within a tractor.	distribution of electrical components within a tractor.	Identify major electrical components and their locations.	Identify major electrical components and their locations
	 8 Discuss the importance of cable management and component accessibility 9 Examine the design considerations for undercarriage and suspension systems. 	Explain the importance of cable management and component accessibility Explain the design considerations for undercarriage and suspension systems	Outline methods to optimize electrical routing for safety and performance.	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.

- 8	3.1 Understand how the	Explain how the	Charts		Guide trainees to:	Tractor
	undercarriage layout	undercarriage layout	White Board			
	affects traction, stability,	affects traction,	Slides	Detect standard cab	Detect standard cab	Steering
	and maintenance.	stability, and	Drawings	configurations and control	configurations and	
	3.2 Understand the function	maintenance.	Projector	placements.	control placements.	Brakes
	of tractor controls and	Explain the function of	Markers Multimedia		T1	Throttle
	instruments	tractor controls and	Computer	Identify and describe the	Identify and	Throttle
	mstruments	instruments	Projector	Identify and describe the purpose of each control	describe the	
		motramento	Digital	purpose of each control	purpose of each control	
	3.3 Discuss the role of	Explain the role of	schematics		control	
	layout in enhancing	layout in enhancing	System			
	operator comfort and	operator comfort and	flowcharts		Operate controls in a	
	efficiency.	efficiency.		Operate controls in a	simulated	
				simulated environment.	environment.	
					Interpret dashboard	
	3.4 Discuss safety hazards	Explain safety hazards		Interpret dashboard	instruments	
	associated with tractor	associated with tractor		instruments		
	layout configurations.	layout configurations.				
					Identify safety	
				Identify safety features and	features and	
				mandatory layout		
				requirements.		

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

	BJECTIVE 4.0: Know Tra	<u> </u>	g Procedures			-
4.2 U s t 4.3 E s 4.4 K of 4.5 E	Describe proper starting and stopping procedures of a tractor. Understand steps for the safe operation of a tractor during start-up and shutdown. Discuss Troubleshoot starting issues. Know steps for the safe operation of a tractor in a field environment. 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	Explain field operation	11	Perform basic	
4.6 Discuss field operation	challenges	Identify and avoid field hazards.	maneuvers with precision.	
challenges				
			Identify and avoid	
			field hazards.	

GENER	AL OBJECTIVE 5.0: Know in	nplement and cab mounting	g correctly to the tra	actor		
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	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	A Functional Tractor Implements (Plough, Harrow, Ridger Trailer) Working Hydraulic System
				Mount cabs on tractor		
	ASSESSMENT CRITERIA	-		-		
	Coursework	Course Test 20%	Practical 60%	Other: Examination/Project	20%	

MODULE: IMPLEMENTS AND MACHINES II	SUBJECT CODE: CAM 222	CONTACT HOURS:
YEAR: 2 TERM: 2	PRE: REQUISITE: CAM 212	THEORETICAL <mark>:</mark>
		PRACTICAL:
OAL: This module is designed to provide the trainee v	8 1	1
machines. GENERAL OBJECTIVE: On completion of this modu	le, the trainee should be able to:	
GENERAL OBJECTIVE: On completion of this modu		
machines. GENERAL OBJECTIVE: On completion of this modu 1.0 Know routine maintenance of crop harvesting equip 2.0 Know routine maintenance of forage harvesting equi	nent	
GENERAL OBJECTIVE: On completion of this modu 1.0 Know routine maintenance of crop harvesting equipr	nent	
GENERAL OBJECTIVE: On completion of this module 1.0 Know routine maintenance of crop harvesting equips 2.0 Know routine maintenance of forage harvesting equi	nent	

PROGR	AMME: NTC IN AGRICU	LTURAL EQUIPMENT	AND IMPLEME	NT MECHANIC WORK C	RAFT PRACTICE		
MODUL	E: IMPLEMENT AND MA	CHINE II	COURSE COI		CREDIT HOURS:		
		-			THEORETICAL:		
YEAR: 2			PRE-REQUIS		PRACTICAL:		
	This module is designed to pro	vide the trainee with the kn	owledge and skills	to perform routine maintena	nce on different farm i	mplements and	
	nachines.				T		
	ETICAL CONTENT	·····	1	PRACTICAL CONTEN	NT		
GENERA WEEK	AL OBJECTIVE 1.0: Know r SPECIFIC LEARNING	TEACHERS	RESOURCES	SPECIFIC LEARNING	TEACHERS	RESOURCES	
WEEK	OUTCOME	ACTIVITIES	RESOURCES	OBJECTIVES	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. 	Explain crop harvesting equipment. Explain types of harvesting equipment: • Fruit harvester • Combine harvester • Root crop harvester, etc.	Marker White Board Textbooks Projector Computer Internet Slides Diagrams Charts	Identify types of crop harvesting equipment Operate harvesting equipment	Guide trainees to: Identify types of crop harvesting equipment Carry out operation of crop harvesting equipment	Farm Toolbox Combine harvester Potato digger Cotton picker Groundnut lifter	
	 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 	Explain the working principles of the main component of a : • Combine harvester • Potato digger • Cotton picker • Groundnut lifter • Other root crop harvesters.		Repair or replace worn out or damage parts. Carry out workshop and field adjustment on crop harvesting equipment	Repair or replace worn out or damage parts. Carryout workshop and field adjustment on crop harvesting equipment	Other root crop harvesters.	
	crop harvesting equipment:	Explain the operation of crop harvesting					

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

<u>gene</u> 4 - 6	RAL OBJECTIVE 2.0: Know t 2.1 Define forage	Explain forage	Marker		Guide trainees to:	Cut and throw
- 0	harvesting equipment	harvesting equipment	White Board	Identify types of forage	Identify types of	harvester
	harvesting equipment	harvesting equipment	Textbooks	harvesting equipment	forage harvesting	nai vester
	2.2 Explain operational	Discuss operational	Projector	harvesting equipment	0 0	Flail type
	principles of forage	Discuss operational principle of forage	U U		equipment	Flail type harvester
	harvesting equipment	harvesting equipment	Computer Internet		Identify	narvester
	harvesting equipment	harvesting equipment	Slides	Identify components of	components of	Combine
	2.2 Describe types of	Evaluin transport formas			-	
	2.3 Describe types of forage harvesting	Explain types of forage harvesting equipment:	Diagrams Charts	forage harvesting	forage harvesting	harvester
	0	• • •	Cilaits	equipment	equipment	
	equipment:	Tractor pulled			Carry out	
	Tractor pulled	• Cut and throw			operation of	
	• Cut and throw	• Flail type		Carry out operation of	forage harvesting	
	• Flail type	• Self-propelled		harvesting equipment	0 0	
	• Self-propelled	(combine		harvesting equipment	equipment	
	(combine	harvester)			Repair and	
	harvester)				·	
					adjust:	
		Explain components of		Poppir and adjust:	• Knife	
	2.4 Describe component of	forage harvesting		Repair and adjust:	assembly	
	forage harvesting	equipment :		• Knife assembly	 Conveyor 	

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

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

	AL OBJECTIVE 4.0: Know r		1	I	1	
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 	Describe the parts of baler: • Pick up mechanism • Knife and shear plates • Tying mechanism		
4.6 Describe the routine maintenance and adjustment of balers	Explain 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 	 Explain the repair and adjust of: Pick up mechanism Packer assembly Ram assembly Knife and shear plates Tying mechanism 		

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

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

GENER	GENERAL OBJECTIVE 2.0: Know routine maintenance of forage harvesting equipment						
4 - 6	2.1 Define forage	Explain forage	Marker		Cut and throw		
	harvesting equipment	harvesting equipment	White Board		harvester		
			Textbooks				
	2.2 Explain operational		Projector		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) 	Discuss operational principle of forage harvesting equipment Explain types of forage harvesting equipment: • Tractor pulled • Cut and throw • Flail type • Self-propelled (combine harvester)	Computer Internet Slides Diagrams Charts	Identify types of forage harvesting equipment	Guide trainees to: know types of forage harvesting equipment	harvester Combine harvester
 2.4 Describe component of forage harvesting equipment: Knife assembly Conveyor Chutes Shear plate Reflectors Gear box 	 Explain components of forage harvesting equipment : Knife assembly Conveyor Chutes Shear plate Reflectors Gear box 		Identify components of forage harvesting equipment	Recognize components of forage harvesting equipment	
2.5 Describe the repair or replacement of worn ou or damage parts	Explain the repair of		 Repair and adjust: Knife assembly Conveyor Chutes Shear plate Reflectors Gear box 	Carryout repair and adjust of : • Knife assembly • Conveyor • Chutes • Shear plate • Reflector • Gear box Repair or replace	

 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) Reciprocating (cutter bar)<!--</th--><th>GENER</th><th>AL OBJECTIVE 3.0: Know</th><th>routine maintenance of mo</th><th>owers</th><th>Repair or replace worn out or damage parts. Carry out workshop and field adjustment on forage harvesting equipment</th><th>worn out or damage parts. Carry out workshop and field adjustment on forage harvesting equipment</th><th></th>	GENER	AL OBJECTIVE 3.0: Know	routine maintenance of mo	owers	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	
Remove and replace or worn parts	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 	 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 	Marker White Board Textbooks Projector Computer Internet Slides Diagrams	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	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	Mower Disc blade mower Reciprocating

				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	
	AL OBJECTIVE 4.0: Know r					
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 	Explain balers Explain the different types of balers e.g.: • Vertical • Horizontal • Cutter bar • Disc. Explain types of bales: • Square • Round • Compressed	Marker White Board Textbooks Projector Computer Internet Slides Diagrams Charts	Identify different types of balers	Guide trainees to: Recognize differen types of balers	Cutter bar mower Disc blade mower Reciprocating mower
	4.4 Discuss the working principle of balers4.5 Describe the parts of baler:	Explain the working principles of balers. Describe the parts of baler:			Identify the following parts: • Pick up mechanism	

CURRICULUM AND MOUDULE SPECIFICATIONS IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANICS WORK CRAFT PRACTICE

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

GENERA	AL OBJECTIVE 5.0: Know	routine maintenance of dai	iry equipment			
13 - 15	5.1 Define Dairy	Explain dairy equipment	Marker		Guide trainees to:	Farm Tool Box
	equipment		White Board			
		Explain Operational	Textbooks			Milking
	5.2 Discuss operational	principle of dairy	Projector			machines
	principles of diary	machine	Computer			
	machine		Internet			Cream separator
		Explain types of dairy	Slides			
	5.3 Describe types of dairy	equipment:	Diagrams	List types of dairy	Identify types of	Cooling
	equipment:	Milking machines	Charts	equipment	dairy equipment	machine
	Milking machines	Cream separator				G. 1.
	Cream separator	Cooling machine				Storage machine
	Cooling machine	• Storage machine				Pasteurizer
	Storage machinePasteurizer	• Pasteurizer				1 ustedrizer
		Parlor feeding				Parlor feeding
	Parlor feeding	system				system
	system	Explain the operation of				5
		dairy machine:				
		Milking				
		machines			Operate dairy	
	5.4 Describe the operation	Cream		Carry out operation of dairy	equipment	
	of dairy machine:	separator		equipment		
	 Milking machines 	Cooling				
	Cream separator	• Cooning machine				
	 Cooling machine 	<u> </u>				
	 Storage machine 	Storage machine				
	 Storage machine Pasteurizer 	 Pasteurizer 				
	Parlor feeding	Parlor feeding				
	system	system				
		Explain the repair of				
		damage parts or				
		replacement of worn-				
		out parts.				
		out parts.				

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%		

MODULE: TRACTOR AND ITS COMPONENTS II	SUBJECT CODE: CAM 231	CONTACT HOURS:
YEAR: 2 TERM: 3	PRE: REQUISITE: CAM 221	THEORETICAL:
		PRACTICAL:
GOAL: This module is designed to provide the trainees with	th the knowledge of tractor and its component	ents
GENERAL OBJECTIVE: On completion of this module, t	he 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, Cylind	ers, control valves)	

PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IM MODULE: TRACTOR AND ITS COMPONENT II			COURSE CODE: CAM 231		Contact HOURS: 180 THEORETICAL:		
	YEAR: 2 TERM: 3				REQUISITE: CAM 221	PRACTICA	L:
	This module is designed to pro-	ovide the trainees with the	ne knowledg	e of trac	1		
	ETICAL CONTENT				PRACTICAL CONTENT		
	AL OBJECTIVE 1.0: Underst	1					
WEEK	SPECIFIC LEARNING	TEACHERS	RESOUR	CES	SPECIFIC LEARNING	TEACHERS	RESOURCES
	OUTCOME	ACTIVITIES			OBJECTIVES	ACTIVITIES	
1-2	1.1 Know the components	Explain the	White Boa			Guide trainees to:	Tractor
	of a tractor	components of a	Multi med				
		tractor	Textbooks				Complete engine
			Computer				
	1.2 Describe tractor main		Internet				Gearbox
	components:	Explain tractor main	Diagrams		Identify components of a	Recognize	
	• Engine	components:	Charts		tractor	components of a	Axles
	• Clutch	• Engine	Markers			tractor	
	• Gearbox	• Clutch					Clutch plate
	• Differential	Gearbox					
	• PTO	 Differential 					РТО
	• Steering	• PTO					
	• Brake	Steering					Steering
	Hydraulic	Brake					- • •
	Rear linkages	Hydraulic					Linkages
	Tyres	Rear linkages					-
	1,105	• Tyres					Tyres
	1.3 Describe functions of						
	tractor components	Explain functions of			List functions of each	Identify functions of	
	• Engine(Cylinder	tractor components			tractor components	each tractor	
	block, pistons,	• Engine(Cylinder				components	
	crankshaft)	block, pistons,				components	
	• Powertrain (Clutch,	crankshaft)					
	gearbox,	• Powertrain(Clutc					
	differential)	h, gearbox,					
	,	differential)					

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

e	Explain tractor engine parts	White Board Multi media	Identify tractor engine parts		Cylinder block
Cylinder block	Cylinder block	Textbooks	Cylinder block		Pistons
Pistons	• Pistons	Computer	Pistons		
Crankshaft	• Crankshaft	Internet Diagrams	• Crankshaft	Guide trainees to: Identify tractor	Crankshaft
		Charts		engine parts	Radiator
2.2 Define internal combustion		Markers	I lead General	 Cylinder block Pistons 	Cooling fan
2.3 Describe internal combustion engine			Identify internal combustion engine	FisionsCrankshaft	Water pump
	Explain internal			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Fuel pump Fuel injection
	combustion			Identify internal combustion engine	system

				Filtration system
	Explain internal combustion engine		Identify the :	Oil pump
		Know the layout of		01.01
2.4 Describe the layout of an internal combustion	Explain the layout of	an internal combust	tion combustion engine.	Oil filter
	an internal combustion engine.	engine.	A compression	Oil galleries
engine.	combustion engine.	Know the compress		On gameries
2.5 Describe the:		ignition, compressi		
Compression		compression pressu		
ignition	Explain the:		pressure.	
Compression ratio	Compression		F	
Compression ratio	ignition		Recognize the	
pressure.	Compression		lubrication system of	
	ratio		Tractor engine	
	Compression			
	pressure.	Identify the lubrica		
2.6 Describe the lubrication		system of Tractor e		
system of Tractor	Explain the		Identify the various	
engine	lubrication system of		types of oil and their viscosities	
• Oil pump	Tractor engine		viscosities	
• Oil filter	• Oil pump		Identify the factors	
Oil galleries	• Oil filter		identify the factors	
	• Oil galleries	Identify the various	s	
	Explain the various	types of oil and the		
2.7 Describe the various	types of oil and their	viscosities		
types of oil and their	viscosities		Recognize the	
viscosities	VISCOSILICS		various	
			types of oil and their	
			viscosities	
		List the factors affe	•	
	Explain the factors	deterioration – long	gusage	
2.8 State the factors	affecting oil	contaminants	Identify factor that	
affecting oil	deterioration – long		Identity factor that	
	usage contaminants			

deterioration – long		Know the cooling system of	affect oil
usage contaminants.	Explain the cooling system of tractor	tractor engine	deterioration – long usage contaminants
 2.9 Describe the cooling system of tractor engine Radiator Cooling fan 	 engine Radiator Cooling fan Water pump 		Identify the cooling system of tractor
Water pump		Recognize fuel system of a tractor engine	engine
 2.10 Describe the fuel system of a tractor engine Fuel pump Fuel injection system Filtration system 	 Explain the fuel system of a tractor engine Fuel pump Fuel injection system Filtration system 		Identify the fuel system of a tractor engine
2.11 Define the principle of fuel injection2.12 Explain the different types of injection pumps	Explain the principle of fuel injection Explain the different types of injection pumps	Identify different types of injection pumps	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 White Board Plate					
			Multi media				
		Explain clutch system	Textbooks			Cylinders	
		operations	Computer				

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

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

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

4.3 Describe mechanical	Explain mechanical	Identify mechanical		Bellows boots
steering.	steering.	steering.	Recognize hydraulic	
			steering	Control arm
4.4 Describe hydraulic	Explain hydraulic	Identify hydraulic steering	Ũ	Ball joints
steering	steering	Identify by drawling line	hydraulically	Springs(coil or
4.5 Describe hydraulically	Explain	Identify hydraulically operated steering	operated steering	leaf)
operated steering	hydraulically	1 8	Recognize the rack	Shock absorbers
4.6 Describe the rack and	operated steering	Identify the male and minia	and pinion steering	Shock absorbers
pinion steering system	Explain the rack and	Identify the rack and pinio steering system	n system	
Rack and pinion	pinion steering		Recognize	
assembly	system	11	suspension system of	
Bellows bootsTie rods	Rack and pinion	Identify suspension system of a tractor	a tractor	
• The rous	assembly			
	Bellows			
4.7 Describe suspension	bootsTie rods			
system of a tractor	• The Tous			
Control arm	Explain suspension			
Ball joints	system of a tractor			
• Springs(coil or leaf)	Control armBall joints			
Shock absorbers	 Springs(coil 			
• Struts	or leaf)			
	Shock absorbers			
	Struts			

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

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

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

MODULE: TRANSMISSION SYSTEM I	SUBJECT CODE: CAM 232	CONTACT HOURS:
YEAR: 2 TERM: 3	PRE: REQUISITE:	THEORETICAL:
		PRACTICAL:
GOAL: This module is aimed at providing the train	nee with the knowledge and skills of tractor transm	ission systems maintenance
CENEDAL OBJECTIVE. On completion of this a	adula the trained should be able to	-
GENERAL OBJECTIVE: On completion of this n	nodule, the trainee should be able to:	<u> </u>
GENERAL OBJECTIVE: On completion of this n 1.0 Understand tractor transmission systems and its o		
	components	-
1.0 Understand tractor transmission systems and its o	components djustment of clutches.	-
1.0 Understand tractor transmission systems and its of2.0 Know the working principles, maintenance and a	components djustment of clutches. f drives and couplings.	-

MODUL	AMME: NTC AND ANTC I JE: TRANSMISSION SYST				URSE CODE: CAM 232		CONTACT	HOURS:
YEAR: 2) TFD	RM: 3		THEORETICAL PRE: REQUISITE: CAM 131 PRACTICAL:				
			nowledge and s	nd skills of tractor transmission systems maintenance				
	ETICAL CONTENT	tuning the trainee with the ki	nownedge and s	KIIIS	PRACTICAL CONTENT		Iteriance	
	AL OBJECTIVE 1.0: Unders	stand tractor transmission sy	vstems and its c	comp				
WEEK	SPECIFIC LEARNING	TEACHERS	RESOURCE		SPECIFIC LEARNING	TEAC	CHERS	RESOURCES
	OUTCOME	ACTIVITIES		~	OBJECTIVES		VITIES	100000000
1-2	1.1 Define Transmission	Explain transmission	Charts				trainees to;	Tractor with
		1	White Board				,	good
	1.2 Discuss functions of	Explain functions of	Slides					transmission
	tractor transmission	tractor transmission	Computer					system
	system	system	Internet					5
		-	Drawings					Implement
			Projector					(trailed,
			Markers					mounted, PTO
		Explain types of	Multimedia					driven
		transmission systems						implement)
	1.4 Discuss types of	Explain components of			List types of	Identif	fy types of	
	transmission system	transmission:			transmission system	transm		Dismantled
		Internal				system		tractor engine
		components				system	1	and
		External						transmission
								system
	1.4 Discuss components of	Explain components of						
	transmission:	transmission:			List components of	Identif	fv	
					transmission system		onents of the	
	• Internal	• Internal				transm		
	components	components				system	1	
	• External	• External						
	components	components						
	1.5 Describe functions of							
	the transmission system:							

CURRICULUM AND MOUDULE SPECIFICATIONS IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANICS WORK CRAFT PRACTICE

 Clutch release PTO operation Hydraulic operation 	 Explain functions of the transmission system: Clutch release PTO operation Hydraulic operation 			,,,,,,,,,	
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3-4	2.1 Explain clutch system	Explain the clutch	Charts			Tractor with
		system	White Board			good
	2.2 Explain categories of		Slides			transmission
	clutches:	Explain categories of	Computer	Identify categories of		
	Positive clutch	clutches:	Internet	clutch systems		Different clutch
	Friction clutch	Positive clutch	Drawings			type
		Friction clutch	Projector			
			Markers			Complete
	2.2 Emploin transport		Multimedia			Clutch
	2.3 Explain types of clutches :				Decemine shutsh	Assembly
	Single plate	Explain types of		List types of clutches	Recognize clutch assembly	system
	Multi-plate	clutches:		List types of clutches	asseniory	Clutch test
	Oil clutch	Single plate Multi plate				bench
	 Hydraulic clutch 	Multi-plateOil clutch			Identify clutch	o enten
	Mechanical clutch	Hydraulic clutch			components	Clutch jig
		 Mechanical 			•	
		clutch				Hand tools
	2.4 Explain the principles of					
	clutch operation	Explain the principles of				Mechanical
	2.5 Explain clutch assembly	clutch operation				Tool box
		Describe clutch				
		assembly.				
	2.6 Discuss components of					
				Identify clutch assembly		

clutch assembly 2.7 Describe the terms: • Spring pressure • Spring compression	Explain components of clutch assembly Explain the terms: • Spring pressure • Spring compression	Ι	List clutch components	Identify the different types of tools used in clutch maintenance Remove clutch assembly
 2.8 Describe the different types of tools used in clutch maintenance e.g.: Clutch jig Hand tool etc. 	Explain the different types of tools used in clutch maintenance e.g.: • Clutch jig • Hand tool etc.	t r H I c S t	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.	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
			Repair and /or replace worn or damaged parts.	

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

		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	

8-10	4.1 Define friction and	Explain friction and	Charts		Guide trainees to;	Bearings of
	lubrication.	lubrication	White Board			different types
			Slides			and shapes
	4.2 Explain reason for	Explain reason for	Computer			_
	lubrication	lubrication	Internet			sliding Engine
			Drawings			parts (piston,
	4.3 Explain the effects of	Explain effects of	Projector			cylinder wall)
	friction and lubrication	friction and lubrication	Markers			
	on moving or sliding	on moving or sliding	Multimedia			TT 1. 1
	parts	parts				Hand tools
	4.4 Define Bearings	Explain Bearings				Lubricating oil
	4.5 Discuss types of	Explain types of				Grease
	bearings and their	bearings and their		List different types of	Identify the	
	functions e.g.:	functions e.g.:		bearings.	different types of	
	Ball bearing	Ball bearing		_	bearing	

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

10-12	5.1 Discuss seals	Explain seals	Charts	Guide trainees to;	Hand Tools
			White Board		
			Slides		Seals
	5.2 Explain types of seals:	Explain types of seals:	Computer		
	Metallic seals	Metallic seals	Internet		Gaskets
	Non-metallic	Non-metallic	Drawings		
	• 'O'ring seals	• 'O'ring seals	Projector		Gasket Marke
	• Gasket	• Gasket	Markers		
	• Dust excluders	• Dust excluders	Multimedia		

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

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

MODULE: TRACTOR UN	NDERCARRIAGE	SUBJECT CODE: CAM 233	CONTACT HOURS:
YEAR: 2	TERM: 3	PRE: REQUISITE: CAM 131	THEORETICAL:
			PRACTICAL:
GOAL: This module is de systems.	esigned to provide the trainee with	knowledge and skills required to efficiently main	itain, diagnose, and repair tractor undercarri
GENERAL OBJECTIVE	: On completion of this module, the	e trainee should be able to:	
GENERAL OBJECTIVE	C: On completion of this module, the	e trainee should be able to:	
	C: On completion of this module, the dercarriages, components and funct		
1.0 Understand Tractor Und	•	ions	
1.0 Understand Tractor Und 2.0 Understand the working	dercarriages, components and funct	ions 1g boxes, steering linkages.	
1.0 Understand Tractor Und 2.0 Understand the working 3.0 Understand working and	dercarriages, components and funct g and operating principles of steerin d operating principles of suspension	ions 1g boxes, steering linkages.	nents.

MODUL	E: TRACTOR UNDERCARRIA	GE	COURSE CO	ODE: CAM 233	CONTACT HO	
					THEORETICA	AL:
YEAR: 2		M: 3	-	ISITE: CAM 131	PRACTICAL:	
GOAL:	This module is designed to provide	the trainee with knowledge and	skills required to e	efficiently maintain, diag	nose, and repair tracto	r undercarriage
	systems.					
	ETICAL CONTENT		1.0		CTICAL CONTEN	
	AL OBJECTIVE 1.0: Understand					
WEEK	SPECIFIC LEARNING	TEACHERS	RESOURCES	SPECIFIC	TEACHERS	RESOURCES
	OUTCOME	ACTIVITIES		LEARNING	ACTIVITIES	
				OBJECTIVES		
1-2	1.1 Define Tractor Under	Explain Tractor Under	Marker		Guide trainees to:	PPE
	Carriage	Carriage	White Board			
			Textbooks			Safety drills
	1.2 Discuss components of	Explain components of	Computer			
	undercarriage such as:	undercarriage such as:	Internet			Workshop tool
	Tracks	Tracks	Projector			
	Rollers	Rollers	Slides			Grease
	Sprockets	Sprockets	Diagrams			
	• Idlers	• Idlers	Charts			
	1.3 Know specific functions of	Explain specific functions of		List the functions of	Recognize the	
	the components listed in 1.2	the components listed in 1.2		the undercarriage	functions of the	
	above	above		system.	undercarriage	
					system.	
	1.4 Distinguish between	Distinguish between		List the major	Identify major	
	different components in 1.2	different components in 1.2		components of	components of	
	above	above		undercarriage	undercarriage	

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

GENE	RAL OBJECTIVE 3.0: Understand v	working and operating principle	s of suspension syst	tem and attached compon	ents.	
5-7	3.1 Define Suspension system	Explain Suspension system	Marker White Board		Guide trainees to:	Trolley jack
		Explain different types of	Textbooks			Axle stand
	3.2 Discuss different types of	suspension system:	Computer			AATC Stallu
	suspension system:	Solid	Internet			Wooden stand
	 Solid 	Liquid	Projector			Wooden stand
	Liquid	Pneumatic	Slides			Hydraulic jack
	Pneumatic suspensions	suspensions	Diagrams			
	• Theumatic suspensions	suspensions	Charts			Suspension pads
		Explain the working				
	3.3 Explain the working	principles of:				
	principles of:	• Solid				
	Solid	• Liquid				
	Liquid	Pneumatic				
	Pneumatic suspensions	suspensions				
	-	-				
		Explain the different types				
	3.4 Describe the different types	of spring:		List the different	Identify the	
	of spring:	Leaf springs		types of spring	different types of	
	• Leaf springs	Torsion bar		oppos or spring	spring	
	Torsion bar	Coil spring			591118	
	Coil spring	• Rubber spring.				
	• Rubber spring.					
	2.5 D	Explain the different types				
	3.5 Describe the different types	of wheels, rims and tire ply		List different types of	Identify different	
	of wheels, rims and tire ply	ratings.		wheels, rims and tire	types of wheels,	
	ratings.			ply ratings.	rims and tire ply	
					ratings.	
				Demesse	Diamantle	
				Remove,	Dismantle, disassemble,	
				disassemble, assemble, and install	assemble, and	
				suspensions.	install suspensions.	
				suspensions.	motan suspensions.	
			1	1	1	1

		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.	

GENER	AL OBJECTIVE 4.0: Understand		o assisted brakes an	d carry out routine mainte	enance of the compone	
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

		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	
4.3 Discuss the working principles of tractor	Explain the working principles of tractor			
hydraulic system	hydraulic system			
transmitting force, pump,	transmitting force,			
seal and valves, filters and	pump, seal and			
hydraulic accumulators	valves, filters and hydraulic			
	accumulators			

GENER	AL OBJECTIVE 5.0: Understand t	he working principles of the bra	akes systems and ca	arry out routine maintena	nce of brake systems.	
10-12	 AL OBJECTIVE 5.0: Understand t 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 	 ne working principles of the bracking explain the braking system 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.	Demonstrate Overhauling Remove, install, dismantle and assemble braking system.	- Brake fluid - Special spammers - Brake fluids- Brake lining - Brake pads - Brake drum - Seals - Air valves
	5.4 Explain the routine maintenance of hydraulic circuit of braking system:			Carry out routine maintenance of	Conduct routine maintenance of	

AdjustmentBleeding 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	hydraulic circuit of braking system. Change brake linings, brake pads and inspect brake
	nyuraune		inspect brake drum. Identify brake pneumatic system.	drum. Identify brake pneumatic system.
			Maintain brake pneumatic system.	Maintain brake pneumatic system. Conduct efficiency test of braking
			Carry out efficiency test of braking system.	system.
ASSESSMENT CRITERIA				
Coursework	Course Test 20%	Practical 60%	Other: Examination/Pr	roject 20%

MODULE: IRRIGA	TION EQUIPMENT	SUBJECT CODE: CAM 234	CONTACT HOURS:
YEAR: 2	TERM: 3	PRE: REQUISITE:	THEORETICAL:
			PRACTICAL:
GENERAL OBJEC	TIVE: On completion of this mo	odule, the trainee should be able to:	
1.0 Understand work	ing of irrigation system and perfo		
	ing of irrigation system and perfo	orm routine maintenance	

	AMME: NTC IN AGRICU					RAFT		
MODUL	E: IRRIGATION EQUIPM	ENT		COURSE CODE: CAM 234			CONTACT HOURS:	
YEAR:	2 TE	RM 3	r	DE DEO	IUCITE.		THEORETICAL PRACTICAL	
	This module is aimed at trained			PRE REQ			FRACTICAL	_i•
	ETICAL CONTENT	ees with the knowledge an	Id Skills of	Ingation	PRACTICAL CONTENT			
	AL OBJECTIVE 1.0: Unders	tand working of irrigation	system an	nd nerform				
WEEK	SPECIFIC LEARNING	TEACHERS	RESOU		SPECIFIC LEARNING	TEA	CHERS	RESOURCES
	OUTCOME	ACTIVITIES	ill so c	Rells	OBJECTIVES		IVITIES	ills o citells
1-4	1.1 Define irrigation	Explain Irrigation	Charts				e trainees to	Pumps
	_		Drawing	<u></u> s				1
	1.2 Define importance of	Explain the role of	Internet					Pipes
	irrigation in	irrigation in agriculture	Compute					
	agriculture.		Projector					Valves
	1.3 Discus types of	Explain types of	Textbool					D
	irrigation systems e.g.:	irrigation systems e.g.:	Markers			:		Emitters.
	Surface	• Surface	White bo Multi me					
	• Sprinkler	• Sprinkler	Multi me	edia				
	• Drip	• Drip						
	-	Explain the						
	1.4 Describe the	components of an						
	components of an	irrigation system e.g.:						
	irrigation system e.g.:	Pumps			List irrigation system	Ident	ify irrigation	
	Pumps	• Pipes			components.	syste	m components	
	• Pipes	Valves						
	• Valves	• Emitters.						
	• Emitters.							
	1.5 Explain the operation	E						
	of an irrigation system	Explain the operation of an irrigation system						
	e.g.:	e.g.:						
	Setting up	• Setting up						
	Scheduling	 Scheduling 						
	 Monitoring 	Monitoring			Identify different irrigation	Reco	gnize	
	C C	- womoning			systems for various crops.		rent irrigation	

	 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	
	AL OBJECTIVE 2.0: Unders	tand trouble shooting tech	· ·	nce of irrigation system		
5-8	2.1 Discuss common problems in irrigation systems and their	Explain common	Charts Drawings Internet		Guide trainees to:	Irrigation system models
	 causes e.g.: Clogging Pressure issues. 	problems in irrigation systems and their causes e.g.: • Clogging • Pressure	Computer Projector Textbooks Markers White board	Diagnose faults by inspection of components Carryout troubleshooting	Find out faults in irrigation system by inspection of components	Maintenance tools (pressure gauges, filter cleaning kits).
	2.2 Discuss troubleshooting techniques for diagnosing and resolving irrigation	Explain troubleshooting	Multi media	techniques for resolving irrigation issues	Conduct troubleshooting techniques for resolving irrigation	Replacement parts (filters, emitters, valves).
	issues e.g.:Checking for leaksTesting pressure	techniques for diagnosing and resolving irrigation issues e.g.:		Dismantle system and fix defective components	issues Dismantle system and fix defective	Safety gear (gloves, goggles).
		Checking for leaks		Carryout hands-on practical tasks related to	components	Field plots

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

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

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

CURRICULUM AND MOUDULE SPECIFICATIONS IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANICS WORK CRAFT PRACTICE

	Explain how to setup irrigation system		Setup and demonstration 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.	
ASSESSMENT	CRITERIA			
Coursework	Course Test 30%	Practical 40%	Other: Examination/Project	30%

PROGRA	MME: NTC IN AGRICULT	URAL EQUIPMENT	AND IMPLI	EMENT MECHANIC WORK (CRAFT PRACTICE			
MODULI	E: TRANSMISSION SYSTE	M II	CO	OURSE CODE: CAM 311	CONTACT HOURS			
					THEORETICAL:			
YEAR:	3 TERM			RE: REQUISITE: CAM232	PRACTICAL:			
	1	ing the trainee with the	knowledge ar	nd skills on maintenance of tractor				
	TICAL CONTENT			PRACTICAL CONT	TENT			
	LOBJECTIVE 1.0: Understa							
WEEK	SPECIFIC LEARNING	TEACHERS	RESOURC			RESOURCES		
	OUTCOME	ACTIVITIES	C1	OBJECTIVES	ACTIVITIES			
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 serv Markers White board Multi media	1	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. 1.3 Explain the process of removing gearbox	Explain tools and equipment used for various jobs on a gear box e.g.: • Pullers • Drifts • Punches • Spanner, etc. Explain the process of removing gearbox		 Identify the tools and equipment used for various on a gear box Remove gearbox frow vehicle. Dismantle, inspect for wear of gear teeth, bushings, shafts and assemble the gear box 	 used for various jobs on a gear box Remove gearbox from a vehicle. Dismantle, inspect for wear of gear teeth, bushings, shafts and assemble 			

	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 	
	L OBJECTIVE 2.0: Underst	and the working princip	les and maintenance of	f a differential and final drives		
4-5	2.1 Define the following:Final DriveDifferential drive	Explain the following:Final DriveDifferential drive	Charts Drawings Project Computer Internet Internet services	Diagnose faults by inspection or road testing	Guide trainees to: Diagnose faults by inspection or road testing	Tractor in the workshop Final Drive Differential Drive
	2.2 Discuss the working principles of a differential	Explain the working principles of a differential	Markers White board Multi media	Remove differential and final drives	Identify differential and final drives	Hand tools

		1	Γ			
		Explain the working		Dismantle the gear teeth or	Inspect the gear teeth or	
	2.3 Describe the working	principles of a final		the sprockets for wear	the sprockets for wear	
	principles of a final	drives units.				
	drives units.				Assemble differential	
		Explain simple line		Assemble differential and	and final drives.	
		diagram of		final drives.		
	2.4 Explain the simple line	differential and final			Check, adjust blacklash	
	diagram of differential	drive.			and other clearance on	
	and final drive.	diive.		Chaple adjust blacklash and	differential and final	
	and milai drive.			Check, adjust blacklash and other clearance on	drives.	
				differential and final drives.	difves.	
				differential and final drives.		
					Observe the relative	
					position of the	
				Observe the relative position	differential and final	
				of the differential and final	drive on the tractor.	
				drive on the tractor.		
GENERA	AL OBJECTIVE 3.0: Underst	and the working princip	les and maintenance of	f the power take off (PTO) drive	2.	
6-7	3.1 Define power take off,	Explain PTO drive	Charts			Tractor in the
	(PTO) drive.	and its working	Drawings			workshop
	× ,	principle.	Project			Dismantled
	3.2 Explain the working	1 1	Computer	Observe the location of PTO	Guide the trainee to	
	principle of a power		Internet	on the tractor	Observe the location of	
	take off, (PTO) drive		Internet services	on the fractor	PTO on the tractor	РТО
	take on, (110) unve		Markers		1 10 on the tractor	110
	2.2 E-mlain the term of		White board			
	3.3 Explain the types of	Describe the types	Multi media	Identify the types of PTO	Recognize the types of	
	PTO drives (540,	of power take off,		drives (540 and 1000 RPM)	PTO drives (540 and	
	1000RPM)	(PTO) drive			1000 RPM)	
				Disassemble, inspect gears		
	3.4 Describe the routine	Explain the routine		and shaft for wear and	Dismantle, inspect gears	
	maintenance and	maintenance and		assemble a PTO unit	and shaft for wear and	
	removal or replacement	removal or			assemble a PTO unit	
	of worn out or damaged	replacement of worn				
1	-		1		1	1
	parts	out or damaged				
	parts	out or damaged parts.				

	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	
	L OBJECTIVE 4.0: Know the			r 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 	Explain what is hydraulic system Explain the working principles of a hydraulic system. Explain the components of the hydraulic system on a tractor	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	Guide the trainee to Identify the various parts of hydraulic system on a tractor. Recognize the various parts of hydraulic system on a tractor.	Tractor with functioning hydraulic system Hydraulic filter Hydraulic pump of differed types Directional control valve
	 Control valves Pistons Reservoirs Filters. 	Evelain the				Cylinder Hydraulic hoses and couplings
	4.4 Discuss the functions of each components of the hydraulic system on a tractor	Explain the functions of each components of the hydraulic system on a tractor Explain faulty		Diagnose and rectify faulty	Find out and rectify	

	 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	
GENER	AL OBJECTIVE 5.0: Know th	e working principles of	hitches – single hitche	s, double hitches, three point hi	tches systems	
8-10	5.1 State the working principles of hitches in a transmission system.	Explain the working principles of hitches in a transmission system	Charts Drawings Project Computer Internet	Carry out adjustments transmission system	Guide the trainee to: Carry out operation adjustments transmission system	Tractor Power farming equipment (harrow, ridger,
	5.2 Discuss the purpose of alternative linkage position5.3 Describe operation	Explain the purpose of alternative linkage position Explain operation adjustments	Internet services Markers White board Multi media	Identify types of top links and stabilizers.	Recognize types of top links and stabilizers.	top link) Implement Tractor
	adjustments 5.4 Outline types of top links and stabilizers.	Explain the types of top links and stabilizers.				Crossbar
	5.5 State different types of drawbars:ChannelSolid	Explain the different types of drawbars: • Channel • Solid • Tabular draw		Identify different types of drawbars	Identify different types of drawbars Carry out routine maintenance of hitches	

	• Tabular draw bars.	bars.			and attachments
	Describe the routine maintenance of hitches and attachments Describe the simple line diagram of hitches.	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.
				Make simple line diagram of hitches.	
ASSESSMENT	Γ CRITERIA				
Coursework	С	Course Test 20%	Practical 40%	Other: Examination/Project 40%	<u>́о</u>

PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT	' AND IMPLEMENT MECHANIC WORK C	RAFT PRACTICE
MODULE: AUTO ELECTRICITY	SUBJECT CODE: CAM 312	CONTACT HOURS:
YEAR: 3 TERM: 1	PRE: REQUISITE:	THEORETICAL:
		PRACTICAL:
GOAL: This module is designed to provide the trainees with th	e fundamentals knowledge and skills of electricit	ty and its application to farm equipment.
GENERAL OBJECTIVE: On completion of this module, the t	rainee should be able to:	
1.0 1.0 Understand the layout of electrical system of a vehicle/tr	actor	
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.		

	AMME: NTC IN AGRICUL' E: AUTO ELECTRICITY		COURSE CODE: (CAM 312	CONTACT HOURS: 1 THEORETICAL:	20
YEAR: 3	TERM: 1	I	PRE: REQUISITE	: CPH 12	PRACTICAL:	
GOAL:	This module is designed to provi	ide the trainees with the fun	damentals knowled	ge and skills of electricity	and its application to farm	n equipment.
		CAL CONTENT			ACTICAL CONTENT	• •
GENER	AL OBJECTIVE 1.0: Understar	nd the layout of electrical sy	stem of a vehicle/tr	actor.		
WEEK	SPECIFIC LEARNING	TEACHERS	RESOURCES	SPECIFIC LEARNING	G TEACHERS	RESOURCES
	OUTCOME	ACTIVITIES		OBJECTIVES	ACTIVITIES	
1	1.1 Define electrical terms:Circuit diagram	Explain electrical terms Circuit diagram 	Marker White board			Wires
	wires/symbols,Define ohm's law	wires/symbols,Define ohm's law	Charts Slides			Relays
	Analog/digital multimeters	Analog/digital multimeters	Multimedia Textbooks			Multimeters
			Computer			Circuit diagram
		Explain tractor circuit diagram:	Internet Projector			Alternator
	 Describe tractor circuit diagram: Wires/terminals Circuit failure Relay, circuit breakers & switches 	 Wires/terminals Circuit failure Relay, circuit breakers & switches 		Identify tractor circuit diagram	Guide trainees to: Identify tractor circuit diagram	
	 1.3 Describe ignition principles Ignition system Secondary resistance cable 	 Explain ignition principles Ignition system Secondary resistance cable 		Identify: Ignition system Secondary resistance cable	Identify: Ignition system Secondary resistance cable	

	 1.4 Describe charging operation principle: DC generator/regulator components Alternator charging circuit 	 Explain charging operation principle DC generator/regulat or components Alternator charging circuit 		Carryout charging operation principles of DC generator components and alternator charging circuit	Carryout charging operation principles of DC generator components and alternator charging circuit Read the tractor	
	 1.5 Describe the tractor electrical system. 1.6 Describe failures analysis on components and wiring 	Explain the tractor electrical system. Explain failures analysis on components and wiring		Interpret the tractor electrical system. Identify failures analysis on components and wiring	Identify failures analysis on components and wiring	
GENE	RAL OBJECTIVE 2.0: Understan	d the theory of wet and dry	cell batteries	1	I	
2-4	2.1 Describe dry and wet battery cells	Explain dry and wet battery cells	Marker White board Charts	Identify dry and wet battery cells.	Guide trainees to: Identify dry and wet battery cells	Dry and wet batteries
	2.2 Distinguish between wet and dry cell of a battery	Explain the differences between wet and dry cell of a battery	Slides Multimedia Textbooks Computer Internet	Identify the differences between wet and dry cell of a battery	Know the differentiate between wet and dry cell of a	Electrolyte
	2.3 Describe battery inspection with:	Explain battery inspection with:	Projector		battery	Hydrometer
	 Volt meter Ampmeter Ohmmeter Hydrometer 	 Volt meter Ampmeter Ohmmeter Hydrometer 		Carry out battery care	Carry out battery care	Battery charger
	2.4 Discuss the care of battery terminals	Explain the care of battery terminals		Identify different battery terminals		

	 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 	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.	
	2.10 Explain the process of battery storage.	· ·		battery	Demonstrate charging of battery	
GENERA	L OBJECTIVE 3.0: Understan	d the starting system	<u> </u>	<u> </u>	<u> </u>	<u> </u>
5-8	3.1 Describe starting circuit	Explain starting circuit	Marker White board		Guide trainees to:	Starter motor
	3.2 List the components of a starter motor.	Explain the components of a starter motor	Charts Slides			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	Recognize the components of a starter motor Repair faulty starter motor Trouble shoot a starter motor system Recognize : • Starting Relay • Voltage regulator • Cranking circuit	Solenoid Armature
				assemble a starter motor and replace faulty or worn out parts	and assemble a starter motor and replace faulty or worn out parts	
	AL OBJECTIVE 4.0: Know the		Marker		Guide trainees to:	Altomators
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.	Recognize alternators and dynamos identify various parts.	Alternators Dynamos

CENED	 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
GENER A 11-12	5.1 Describe various		Marker	1	Guide trainees to:	Circuit dia ang
11-12	5.1 Describe various cranking safety circuits	Explain various cranking safety circuits	Marker White board Charts Slides Multimedia	Observe safety during cranking	Demonstrate safety during cranking	Circuit diagram Battery
	5.2 Describe safe practice for testing procedures.	Explain safe practice for testing procedures.	Textbooks Computer Internet	Conduct safe testing	Conduct safe testing	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

CourseworkCourse Test 20%Practical 40%Other: Examination/Project 40%
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MODULE: HARVESTING AND POST HARVESTING	SUBJECT CODE: CAM 313	CONTACT HOURS:
YEAR: 3 TERM: 1	PRE: REQUISITE:	THEORETICAL <mark>:</mark>
		PRACTICAL:
COAL: This module is designed to provide the trainee with t produce.		- F
GENERAL OBJECTIVE: On completion of this module, th	e trainee should be able to:	
GENERAL OBJECTIVE: On completion of this module, the 1.0 Understand the harvesting techniques of agricultural production of the statement of		
1.0 Understand the harvesting techniques of agricultural produ		
1.0 Understand the harvesting techniques of agricultural produce2.0 Know post-harvest technologies of agricultural produce	ıce.	

PROGRA	AMME: NTC IN AGRICU	LTURAL EQUIPMEN	NT AND IMP	LEM	IENT MECHANIC WORK (CRAFT PRACTICE		
MODUL	E: HARVESTING AND PO	STHARVESTING		COU	RSE CODE: CAM 313		CONTACT HOURS: 120	
							THEORETICAL:	
YEAR: 3		RM: 3			: REQUISITE:	PRACTICAL:		
	This module is designed to pro-	ovide the trainee with th	e knowledge a	and sk		vest technology of agric	ultural produce	
	ETICAL CONTENT				PRACTICAL CONTENT			
	AL OBJECTIVE 1.0: Know the second sec	<u> </u>	U	-				
WEEK	SPECIFIC LEARNING OUTCOME	TEACHERS ACTIVITIES	RESOURC	ES	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. 	 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 	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	
	1.5 Describe the basic concepts related to crop yields (yield estimation)							

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

2.3 Describe equipment and	Explain equipment		D.	
material used for postharvest operations	and material used for postharvest	Identify equipment and material used for	Recognize equipment and	Washers
of crops:	operations of crops:	postharvest operations of	material used for	
• Tarpaulin	Tarpaulin	crops	postharvest operations of crops	Sticks
Mats machine driersWinnower	 Mats machine driers 		operations of crops	Sticks
Sieves	Winnower			
• Destoner	• Sieves			Mechanical
• Washers	• Destoner			sheller
SticksMechanical sheller	WashersSticks			
We chance a shereThresher	Mechanical			Thresher
Bags/sacks	sheller			
Plastic and wooden	• Thresher			
crates Silo 	Bags/sacksPlastic and			Bags/sacks
Hermetic bags	wooden crates			
• Underground pits,	• Silo			Plastic and
etc.	Hermetic bags			wooden crates
	• Underground pits, etc.			
	1			Silo
	Explain the			
	postharvest techniques for			
2.4 Describe the	different crops			Hermetic bags
postharvest techniques				
for different crops	Explain the			
	facilities use for post	Know the postharvest	Carry out the	
2.5 Describe the facilities	harvesting	techniques for different	postharvest	
use for post harvesting	operations techniques for	crops	techniques for different crops	
operations techniques for different crops	different crops		anterent erops	
tor annorent crops				

	 2.6 Describe common postharvest 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	
GENERA	AL OBJECTIVE 3.0: Underst	and storage structures for				
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 	Explain the types of crop storage structures Explain the features /criteria to consider for best crop storage		Identify the types of crop storage structures Know the features /criteria to consider for best crop storage structures	Recognize the types of crop storage structures Recognize the features /criteria to consider for best crop	
	storage	Explain conditions necessary for good storage		Know conditions necessary for best crop storage	storage structures Identify conditions necessary for best crop storage	
GENER 8-12	 AL OBJECTIVE 4.0: Underst 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 	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	p storage activities Multimedia White board Computer Projector Internet Flipcharts Maker Textbooks	for crops stored. Identify fumigation process Identify the types of fumigants	Guide trainees to: Identify fumigation process Recognize the types of fumigants	Storage facility Fumigants Knapsacks PPE
	4.5 Describe factors for success and failure for fumigation	fumigants Explain factors for success and failure for fumigation		Identify factors for success and failure for fumigation Know causes of loses in crop storage	Identify factors for success and failure for fumigation	

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

AS	SSESSMENT CRITERIA			
Co	oursework	Course Test 20%	Practical 30%	Other: Examination/Project 50%

PROGRAMME: NTC IN AGRICULTURAL EQUIPMEN	NT AND IMPLEMENT MECHANIC WC	DRK CRAFT PRACTICE
MODULE: MACHINERY MANAGEMENT	SUBJECT CODE: CAM 321	CONTACT HOURS:
YEAR: 3 TERM: 2	PRE: REQUISITE: CAM 222	THEORETICAL:
		PRACTICAL:
GOAL: This module is aimed at providing the trainee with k	nowledge and practical skills of selecting ag	ricultural machinery and tractors.
GENERAL OBJECTIVE: On completion of this module, th	e 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 tracto	or- equipment	

PROGR	AMME: NTC AND ANTC IN	AGRICULTURAL EC	QUIPMENT AN	ND IMPLEMENT MECHANI	C WORK CRAFT PRAC	TICE
MODUL	E: MACHINERY MANAGEM	IENT		COURSE CODE: CAM 321	CONTACT HOU	
					THEORETICAL	
YEAR:	3 TERM	M: 2		PRE: REQUISITE: CAM 222	2 PRACTICAL: H	OURS
GOAL:	This module is aimed at provid	ing the trainee with know	wledge and prac	tical skills of electing agricultura		
	ETICAL CONTENT			PRACTICAL CONTE	NT	
GENERA	AL OBJECTIVE 1.0: Understa	and factors affecting trac	tor selection			
WEEK	SPECIFIC LEARNING	TEACHERS	RESOURCE	S SPECIFIC LEARNING	TEACHERS	RESOURCES
	OUTCOME	ACTIVITIES		OBJECTIVES	ACTIVITIES	
1-3	1.1 Define machine selection	Explain machine	Charts		Guide trainees to:	Tractor
	in the context of tractor	selection in the	White Board			
	machinery management.	context of tractor	Computer			implements
		machinery	Internet			Data sheets from
		management.	Slides			tractor
	1.2 Explain factors		Drawings			manufacturers.
	influencing tractor	Explain factors	Projector	Know key factors	Identify key factors	
	selection:	influencing tractor	Markers	influencing tractor	influencing tractor	
	• Horsepower	selection:	Multimedia	selection	selection	Data sheets from
	• Implement	 Horsepower 				implement
	compatibility	• Implement				manufacturers
	• Terrain	compatibility				
	1 2 D:	• Terrain			Decession in the steel	
	1.3 Discuss types of tractors	Englain trunca of		Identification temperature	Recognize tractor types and their	Cost calculators
	and their applications:	Explain types of tractors and their		Identify tractor types and	21	Cost culculators
	• Utility	applications:		their applications based on utility, row-crop.	applications based on utility, row-	Sheets for fuel,
	Row-crop	* *		orchard)	crop, orchard	maintenance,
	• Orchard	e unity		orenard)	crop, orenard	and ownership
	1.4 Discuss tools and	Row-crop				costs.
	resources for evaluating	• Orchard				
	tractor performance:	Explain tools and resources for				
	Manufacturer specs					
	• Cost-benefit analysis	evaluating tractor performance:				
		Manufacturer				
	1.5 Discuss Tractor selection	specsCost-benefit				
	1.5 Discuss Tractor selection	• Cost-benefit				

	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	
-	AL OBJECTIVE 2.0: Understan	5			0.1.1	T
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. 	Explain types of implements (e.g., Trailed, mounted and semi mounted) Explain factor considered in selecting implements/machiner y Machine performance Total machine cost including ownership cost, labour cost, operation cost, 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	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	Tractor implements Charts
	 2.3 Describe factors affecting determination of machine size: Field size Labour supply Tillage practices, etc. 	Explain factors affecting determination of machine size: • Field size • Labour supply • Tillage practices, etc.		performance.	performance.	

				1		1
	2.4 Explain the importance of	Explain the				
	operational costs in	importance of				
	machine selection:	operational costs in				
	Fuel efficiency	machine selection:				
	Maintenance	• Fuel efficiency				
	Resale value	Maintenance				
		Resale value				
GENER	RAL OBJECTIVE 3.0: Know the	e principle of matching	tractor- equipment			
7 - 9	3.1 Explain the process of	Explain the process	Charts		Guide trainees to:	Tractor
	matching tractors to	of matching tractors	White Board	Analyze operational	Analyze operational	implements
	implements:	to implements:	Computer	efficiency in tractor-	efficiency in tractor-	_
	• Plows	• Plows	Internet	implement pairing	implement pairing	GPS
	• Harvesters	 Harvesters 	Slides			
	• Loaders.	• Loaders.	Drawings			
			Projector			
	3.2 Explain selection of a	Explain selection of a	Markers	Identify a tractor-	Select a tractor-	
	tractor and implement for	tractor and implement		implement combination	implement	
	a specific farming	for a specific farming		for a specific farming	combination for a	
	operation	operation		operation based on given	specific farming	
		•		criteria	operation based on	
		Explain the role of			given criteria.	
	3.3 Discuss the role of	technology in modern				
	technology in modern	tractor-implement				
	tractor-implement	systems:				
	systems:	• GPS				
	• GPS	Precision				
	 Precision farming 	farming				
		Iaiiiiig				

GENERA	AL OBJECTIVE 4.0: Understa	nd management of selec	tion and matching	tractor- equipment		
10 - 12	4.1 Discuss financing options, government subsidies, and vendor incentives related to machinery procurement.	Explain financing options, government subsidies, and vendor incentives related to machinery procurement.	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.	Guide trainees to: Select a proposal based on technical, economic, and sustainability factors.	Tractor implement Digital tools Logbook
	4.2 Explain vendor evaluation and negotiation strategies to secure favorable purchase and service agreements.	Explain vendor evaluation and negotiation strategies to secure favorable purchase and service agreements.		Develop vendor evaluation and negotiation strategies to secure favorable purchase and service agreements. Maintain accurate records of evaluations, analysis	Identify vendor evaluation and negotiation strategies to secure favorable purchase and service agreements. Apply accurate records of evaluations, analysis	
	 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 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				

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

PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE						
MODULE: MAINTENANCE AND TROUBLESHOOTING OF TRACTORS	SUBJECT CODE: CAM 322	CONTACT HOURS:				
YEAR: 3 TERM: 2	PRE: REQUISITE: CAM 221	THEORETICAL:				
		PRACTICAL:				
GOAL: This module is aimed at providing trainee with the knowledge and skills to maintain and troubleshoot tractors 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						
4.0 Know troubleshooting operations of tractors						

	AMME: NTC AND ANTC IN E: MAINTENANCE AND TR			D IMPLEMENT MECHANIC V COURSE CODE: CAM 322	VORK CRAFT PRAC	
					THEORETICAL:	
YEAR:	YEAR: 3 TERM: 2			PRE: REQUISITE: CAM 221	PRACTICAL:	
GOAL:	This module is aimed at provid	ing trainee with the knowled	dge and skills t	o maintain and troubleshoot tractor	rs	
	ETICAL CONTENT			PRACTICAL CONTENT		
GENER	AL OBJECTIVE 1.0: Underst	and routine maintenance of				
WEEK	SPECIFIC LEARNING	TEACHERS	RESOURCE		TEACHERS	RESOURCES
	OUTCOME	ACTIVITIES		OBJECTIVES	ACTIVITIES	
1-3	1.1 Define routine maintenance	Explain routine maintenance	Charts Whiteboard Computer Internet	Identify routine maintenance	Guide trainees to: Identify routine maintenance	Tractor models
	 1.2 Discuss routine maintenance: Checking fluid levels Greasing fittings Replacing filters 	 Explain routine maintenance: Checking fluid levels Greasing fittings Replacing filters 	Slides Drawings Projector Markers Multimedia	Identify key components of a tractor that require regular maintenance. Follow maintenance schedules and perform routine tasks: • Oil changes • Filter replacements	Identify key components of a tractor that require regular maintenance. Follow maintenance schedules and perform routine tasks: • Oil changes	Maintenance tools (e.g., wrenches, grease guns, oil filter removers). Diagnostic equipment (e.g., multimeters, pressure gauges, OBD scanners).
	1.3 Discuss the importance of maintenance in tractor performance and longevity	Explain the importance of maintenance in tractor performance and longevity			 Filter replacements 	Replacement parts (e.g., filters belts, fluids). Safety gear (e.g.,
	 1.4 Explain the key components of a tractor that require regular maintenance: Engine Transmission 	Explain the key components of a tractor that require regular maintenance:				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 				
<u>GENEI</u> 4-6	 RAL OBJECTIVE 2.0: Underst 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 	 and maintenance of commo 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 	n tractor problems 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
GENEI 7-9	RAL OBJECTIVE 3.0: Know to 3.1 Explain tools and equipment for tractor	bols and equipment for tract Explain tools and equipment for tractor	or maintenance and Charts White Board Computer	I troubleshooting operations Identify tools and equipment for tractor	Guide trainees to: Select tools and equipment for	Tractor maintenance manuals

	• • •	• . 1	T	•	• • •	
	maintenance and	maintenance and	Internet	maintenance and	tractor maintenance	
	troubleshooting.	troubleshooting.	Slides	troubleshooting	and troubleshooting	Manufacturer
			Drawings			technical
			Projector		Conduct	bulletins, and
			Markers	Carryout troubleshooting	troubleshooting	schematics.
	3.2 Discuss troubleshooting	Explain troubleshooting	Manual National	operation on a tractor	operation on a	
	operation on a tractor	operation on a tractor	Standards		tractor	National safety
						standards and
				Carry out maintenance	Conduct maintenance	0
	3.3 Describe maintenance	Explain maintenance of		activities	activities	tractor
	of the troubleshooting	the troubleshooting				maintenance.
	result in 3.3	result in 3.3				
						Digital diagnostic
						tools
						Templates for
						maintenance
						checklists
						Electronic
						logbooks
						-
						Repair
						documentation.
GENERA	AL OBJECTIVE 4.0: Know tr	oubleshooting operations of	f tractors			
10-12	4.1 Discuss troubleshooting	Explain troubleshooting	Charts		Guide trainees to:	Tractor
	techniques use for	techniques for use	White Board	Identify trouble shooting	Identify trouble	maintenance
	diagnosing :	diagnosing :	Computer	techniques	shooting techniques	manuals
	Visual inspections	Visual	Internet	*		
	 Diagnostic tools 	inspections	Slides			Manufacturer
	 Systematic testing 	 Diagnostic tools 	Drawings			technical
	- Systematic testing	 Systematic 	Projector			bulletins, and
	4.2 Describe common	testing	Markers			schematics.
	engine problems using	woning			Conduct diagnoses	
	systematic	Explain common engine			of common engine	National safety
	troubleshooting	problems using			problems using	standards and
	methods.	systematic			systematic	guidelines for
	memous.	Systematic			Systematic	Saradinies for

 Oil leaks Oil leaks Misfires Overheating Oil leaks Overheating Oil leaks Oil leaks Oil leaks Oil leaks Oil leaks Oil leaks Use electronics diagnostic tools diagnostic tools Multimeters Scan tools Thermal cameras 	maintenance. Digital diagnostic tools Templates for maintenance checklists Electronic logbooks
 Overheating Overheating Oil leaks Oil leaks Oil leaks Oil leaks Oil leaks Oil leaks Use electronics diagnostic tools Multimeters Scan tools Thermal cameras Thermal cameras 	tools Templates for maintenance checklists Electronic
4.3 Discuss diagnostic tools to identify electrical and electronic issues: • Multimeters • Scan tools • Thermal cameras• Oil leaksUse electronics diagnostic tools to identify electrical and electronic issues: • Multimeters • Scan tools • Scan tools • Thermal cameras• Oil leaksUse electronics diagnostic tools to identify electrical and electronic issues: • Multimeters • Scan tools • Thermal cameras• Oil leaksUse electronics diagnostic tools•4.4 Discuss how to troubleshoot hydraulic system issues:• Multimeters • Scan tools • Thermal cameras• Carry out troubleshoot hydraulic troubleshoot hydraulic• Carry out troubleshoot hydraulic• Carry out 	tools Templates for maintenance checklists Electronic
Inspire toolsConnectionUse electronicsto identify electrical and electronic issues:Explain diagnostic tools to identify electrical and electronic issues:Use electronics diagnostic tools• Multimeters • Scan tools • Thermal cameras• Multimeters • Scan tools • Scan tools • Thermal cameras• Use electronics diagnostic toolsI4.4 Discuss how to troubleshoot hydraulic system issues:• Explain how to 	Templates for maintenance checklists Electronic
Internity electrical and electronic issues:Explain diagnostic tools to identify electrical and electronic issues:diagnostic tools• Multimeters • Scan tools • Thermal cameras• Multimeters electronic issues:• Use electronics diagnostic tools• I4.4 Discuss how to troubleshoot hydraulic system issues:• Explain how to 	maintenance checklists Electronic
 Multimeters Scan tools Thermal cameras 4.4 Discuss how to troubleshoot hydraulic system issues: Inplain inglotic tools to identify electrical and electronic issues: Multimeters Scan tools Thermal cameras Use electronics diagnostic tools Carry out troubleshoot hydraulic Explain how to troubleshoot hydraulic 	maintenance checklists Electronic
 Scan tools Thermal cameras 4.4 Discuss how to troubleshoot hydraulic system issues: Identify creation and electronic issues: Multimeters Scan tools Thermal cameras Use electronics diagnostic tools Carry out troubleshoot hydraulic 	checklists Electronic
 Scan tools Thermal cameras Multimeters Scan tools Thermal cameras Use electronics diagnostic tools Thermal cameras Thermal cameras Explain how to to troubleshoot hydraulic system issues: 	Electronic
 A.4 Discuss how to troubleshoot hydraulic Explain how to troubleshoot hydraulic Explain how to troubleshoot hydraulic 	
4.4 Discuss how to troubleshoot hydraulic system issues: Explain how to troubleshoot hydraulic Carry out troubleshooting I	
4.4 Discuss how to troubleshoot hydraulic system issues:	logbooks
troubleshoot hydraulicExplain how toCarry outIsystem issues:troubleshoot hydraulictroubleshootingd	
system issues: troubleshoot hydraulic troubleshoot issues troubleshoot hydraulic troublesho	Densin
SVSIETITISSUES. LIQUDIESTIQUI IIVUTAUTU	Repair
	documentation
Pressure drops System issues: A control of activity on hydraulic system	
Leaks. Pressure drops Identify faults in hydraulic	
• Leaks.	
4.5 Describe the condition	
of cooling systems, Explain the condition of troubleshooting	
identifying problems cooling systems,	
like: identifying problems system	
Blocked radiators like: Carry out troubleshooting	
Faulty fans Blocked activity on cooling system Conduct	
Thermostat failures. radiators troubleshooting	
Faulty fans activity on fuel	
Thermostat Carry out troubleshooting system	
4.6 Discuss issues in the fuel failures. activity on fuel system	
system: Clogged filters Explain issues in the fuel	
Injector system: malfunctions. Clogged filters	
Injector	
4.7 Discuss transmission and malfunctions.	
drivetrain performance	
to detect abnormal	

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

PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE								
MODULE: WHEE	ELS AND TIRES	SUBJECT CODE: CAM 323	CONTACT HOURS:					
YEAR: 3	TERM: 2	PRE: REQUISITE:	THEORETICAL <mark>:</mark>					
			PRACTICAL:					
	GOAL: This module is aimed at providing the trainee with knowledge and practical skills for inspecting, maintaining, diagnosing, and repairing tractor wheels and tires							
GENERAL OBJECTIVE: On completion of this module, the trainee should be able to:								
1.0 Understand Whe	eels and Tires in Tractors and impler	nents						
2.0 Understand Tire	e threads and tire aids in tractor whee	ls and tires						
3.0 Know wheel alignment of tractor tires								
4.0 Understand Tractor tire aids -tractor chain								

	AMME: NTC AND ANTC IN	N AGRICULTURAL E	-			ГІСЕ
MODUL	E: WHEELS AND TIRES		COURSE	CODE: CAM 323	CONTACT HOURS:	
					THEORETICAL:	
YEAR: 3				QUISITE: 131	PRACTICAL: Hours	
GOAL:	This module is aimed at provid	ding the trainee with know	wledge and practi	cal skills for inspecting, mainta	ining, diagnosing, and repai	ring tractor wheels
THEOD	and tires					
	ETICAL CONTENT AL OBJECTIVE 1.0: Unders	tond Wheels and Time in	Tuestene en line	PRACTICAL CONTENT	-	
WEEK	SPECIFIC LEARNING	TEACHERS	RESOURCES	SPECIFIC LEARNING	TEACHERS	RESOURCES
WEEK	OUTCOME	ACTIVITIES	RESOURCES	OBJECTIVES	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.	identify the components of a tractor tire Identify radial, bias- ply, and flotation tires	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.

1	 Flotation. 1.4 Discuss the factors influencing tire selection: Soil type Load capacity Traction requirements. 	Explain the factors influencing tire selection: • Soil type • Load capacity • Traction requirements.	Identify appropriate tires based on soil type, load capacity, and traction requirements.	Select appropriate tires based on soil type, load capacity, and traction requirements.	Safety gear (e.g., gloves, goggles, protective clothing).
1	1.5 Describe the importance of tire pressure and its impact on performance and wear.	Explain the importance of tire pressure and its impact on performance and wear.	Identify tire pressure and its impact on performance.	Inspect tire pressure and its impact on performance.	
1	1.6 Explain the process of checking and adjusting tire pressure	Explain the process of checking and adjusting tire pressure	Carryout checking and adjusting tire pressure	Demonstrate the process of checking and adjusting tire pressure	

4-6	2.1 Describe the function of	Explain the function	Charts		Guide trainees to:	Tractor
	tire tread patterns and	of tire tread patterns	White Board	Identify the function of	Identify the function of	
	their suitability for	and their suitability	Computer	tread patterns and their	tread patterns and their	Tires
	different terrains.	for different terrains.	Internet	suitability for different	suitability for different	
			Slides	terrains.	terrains.	Liquid ballast
			Drawings			
		Evaluia the concept	Projector			Weights
		Explain the concept	Markers	Identify ballasting and its		
	2.2 Describe the concept of	of tire ballasting and	Multimedia	role in improving traction.		
	tire ballasting and its	its role in improving		Tote in improving fraction.		
	role in improving					

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

		Demonstrate the	
		process of adding	
		ballast to tractor tires	

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

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

 4.3 Describe the safety precautions for workin with tractor wheels and tires. 4.4 Discuss inspection step of tractor wheels and tires 	Working with tractor wheels and tires. Explain inspection		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 CRITER	IA	1	l	
Coursework	Course Test 20%	Practical 40%	Other: Examination/Project	40%

MODULE: MAINTENANCE OF PRECISION AGRICULTURAL EQUIPMENT AND MACHINES	SUBJECT CODE: CAM 331	CONTACT HOURS:
YEAR: 3 TERM: 3	PRE: REQUISITE:	THEORETICAL:
		PRACTICAL:
GOAL: This module is aimed at providing trainee with kn agricultural equipment GENERAL OBJECTIVE: On completion of this module, t		naintain, troubleshoot, and calibrate precisio
GENERAL OBJECTIVE. On completion of this module, t	he trainee should be able to:	
1.0 Know precision equipment system inspection and diagno		
	stics	,
1.0 Know precision equipment system inspection and diagno	stics ent components and Software Maintenance	;

	E MAINTENANCE OF PRECIS ACHINES	SION AGRICULTURAL	EQUIPMENT	COURSE CODE: CAM 3	331 CONTACT THEORET	
YEAR:	3 YEAR:	3		PRE: REQUISITE:	PRACTIC	AL:
	This module is aimed at providi equipment ETICAL CONTENT	ng trainee with knowledg	-	ills necessary to maintain, trop ACTICAL CONTENT	ubleshoot, and calibrate pro-	ecision agricultur
	AL OBJECTIVE 1.0: Know pred	cision equipment system				
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 	 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 	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.	Guide trainees to: Recognize the operational principles behind GPS guidance, sensor integration, and variable rate application systems.	Diagnostic and calibration software tools Manufacturer technical manuals Digital schematics Digital diagnostic and calibration too Templates for electronic logbooks
	hardware and software components in precision equipment.	Explain the integration of hardware and software components in precision equipment.		Identify how precision equipment integrates hardware and software to achieve field accuracy.	Identify how precision equipment integrates hardware and software to achieve field accuracy.	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.	visua inspe syster Use d asses	yout comprehensive al and digital ections of precision ag ems. diagnostic tools to	Conduct comprehensive visual and digital inspections of precision ag systems. Use diagnostic tools to assess sensor health and connectivity.	
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2.2 Explain GPS, R Kinema other so high po	ctions and entive maintenance ectronic and	inspections and	White Board			Diagnostic and
2.2 Explain GPS, R Kinema other so high po		· ·				calibration
2.2 Explain GPS, R Kinema other so high po 2.3 Explain	ectronic and	preventive	Slides			software tools
 2.2 Explain GPS, R Kinema other so high pc 2.3 Explain 		maintenance on	Drawings			
GPS, R Kinema other so high po 2.3 Explain	anical components.	electronic and	Projector			Manufacturer
GPS, R Kinema other so high po 2.3 Explain		mechanical	Computer			technical
GPS, R Kinema other so high po 2.3 Explain		components.	Internet			manuals
GPS, R Kinema other so high po 2.3 Explain	in calibration of		Markers			D: : 1
Kinema other so high po 2.3 Explain	RTK (Real-Time	Explain calibration of	Multimedia	Apply precise calibrations		Digital
other so high po 2.3 Explain	matic) systems, and	GPS, RTK (Real-	Disital	of GPS and RTK systems	Perform precise calibrations of GPS	schematics
2.3 Explain	sensors to ensure	Time Kinematic) systems, and other	Digital schematics	to ensure optimal	and RTK systems to	Digital
-	positional accuracy.	sensors to ensure high	System	accuracy.	ensure optimal	diagnostic and
-		positional accuracy.	flowcharts		accuracy.	calibration tools
		positional accuracy.			uccurucy.	
-						Templates for
-						electronic
						logbooks
-	• • • •					
	in communication					Maintenance
	onnectivity issues					checklists
compo	een equipment					

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

GENERA	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				

	• Weather conditions	Markers Multimedia		recommend protective measures.	
 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. 	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.	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.	Apply strict safety protocols when handling sensitive electronics and high- voltage components. Perform software diagnostics on integrated precision systems.	
3.4 Explain maintenance procedures and repair histories in standardized	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	Explain safety protocols and use appropriate personal protective equipment (PPE) when working with high-voltage or sensitive electronic systems. Explain software diagnostian using				
diagnostics using simulation tools and	diagnostics using simulation tools and				

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.	
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GENER	AL OBJECTIVE 4.0: Understan	d Data Integration, Reco	rd keeping and Rep	porting of maintenance of preci	sion equipment	
0 - 12	4.1 Explain a preventive maintenance schedule tailored to the operational demands and environmental conditions of precision equipment.	Explain a preventive maintenance schedule tailored to the operational demands and environmental conditions of precision equipment.	Charts White Board Slides Drawings Projector Computer Internet Markers	Develop and implement a preventive maintenance schedule based on equipment usage and environmental conditions.	Guide trainees to: Develop and implement a preventive maintenance schedule based on equipment usage and environmental conditions.	Software
	4.2 Explain how to collaborate with technical support teams and vendors for complex system issues or updates.	Explain how to collaborate with technical support teams and vendors for complex system issues or updates.	Multimedia Digital schematics System flowcharts	Know calibration settings, repair actions, and system performance in an electronic logbook.	Document calibration settings, repair actions, and system performance in an electronic logbook.	
	4.4 Describe how to integrate data from precision equipment into farm management software for continuous performance monitoring	Explain how to integrate data from precision equipment into farm management software for continuous		Integrate sensor data into farm management software and analyze trends for maintenance planning.	Integrate sensor data into farm management software and analyze trends for maintenance planning. Carry out detailed	
					technical reports and	

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

PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANIC WORK CRAFT PRACTICE									
MODULE: TRACTORS AND THEIR POWER UNIT	SUBJECT CODE: CAM 332	CONTACT HOURS:							
YEAR: 3 TERM: 3	PRE: REQUISITE:	THEORETICAL:							
		PRACTICAL:							
GOAL: This module is designed to provide the trainee with released and lubricating systems).	evant knowledge of the components of a p	ower unit (engine components, fuel, cooling,							
GENERAL OBJECTIVE: On completion of this module, the	trainee should be able to:								
1.0 Understand the working principles of an internal combustion	n engine.								
2.0 Understand the general layout and working principles of fue	el systems.								
3.0 Understand the basic diesel fuel injection system.									
4.0 Understand the basic working principles of cooling system	4.0 Understand the basic working principles of cooling system								
5.0 Understand lubrication system									

PROGRAMME: NTC IN AGRICULTURAL EQUIPMENT ANDMODULE: TRACTORS AND THEIR POWER UNIT			DE: CAM 332	Contact HOURS: 180 THEORETICAL:		
YEAR: 3	3 TER	M: 3	PRE: REQUIS	SITE:	PRACTICAL:	
				e components of a power unit (e		, cooling, and
	lubricating systems).			·		_
	ETICAL CONTENT			PRACTICAL CONTENT		
	AL OBJECTIVE 1.0: Unders				1	1
WEEK	SPECIFIC LEARNING OUTCOME	TEACHERS ACTIVITIES	RESOURCES	SPECIFIC LEARNING OBJECTIVES	TEACHERS ACTIVITIES	RESOURCES
1-2	1.1 Define internal combustion	Explain internal combustion	White Board Multimedia Textbooks			Tools box Complete
	1.2 Describe the layout of an internal combustion engine	Explain the layout of an internal combustion engine	Diagrams Charts Computer Internet	Identify internal combustion Identify the layout of	Guide trainees to: Identify internal combustion	Engine model Work table
			Markers	an internal combustion engine	Draw the layout of an internal combustion engine	
	 1.3 Define the following terms: Two Stroke cycle Engine Four Stroke cycle Engine 	Explain the following terms • Two Stroke cycle Engine • Four Stroke cycle Engine		 Identify the following: Two Stroke cycle Engine Four Stroke cycle Engine 	Recognize the following: • Two Stroke cycle Engine • Four Stroke cycle Engine	
	1.4 Describe the working principle of two strokes cycle engine	Explain the working principle of two strokes cycle engine Explain the working principle of four Stroke cycle engine		Identify the working principle of two strokes cycle engine.	Recognize the working principle of two strokes cycle engine.	

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

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

Fuel injectorNozzles etc.	Fuel injectorNozzles etc.	Internet Markers			
			Identify diesel fuel components: • Fuel pump • Fuel tank • Fuel lures • Fuel filter • Fuel injector • Nozzles etc.	Recognize diesel fuel components: • Fuel pump • Fuel tank • Fuel lures • Fuel filter • Fuel injector • Nozzles etc.	
2.2 Describe the various components of fuel system	Explain the various components of fuel system		Identify the various components of fuel system	Recognize the various components of fuel system Differentiate between petrol and	
2.3 Describe difference between petrol and diesel fuel system2.4 Describe the working principle of the fuel li pump, in line and	Explain the difference between petrol and diesel fuel system Explain the working principle of the fuel lift pump, in line and		Differentiate between petrol and diesel fuel system Know the working principle of the fuel lift	diesel fuel system Identify the working principle of the fuel lift pump, in line and distributor injection,	
distributor injection pump, filters injectors governors and cold starting.	distributor injection,		pump, in line and distributor injection, pump, filters injectors, governors and cold starting	pump, filters injectors,	

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

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

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

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

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 4	40%	

PRACTICAL MANUAL AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANICS

HEALTH, SAFETY AND	Identify safety equipment and wears essential in the workplace/environment
ENVIRONMENT	Demonstrate how to use safety equipment and wears essential in the workplace/environment
CAM 111	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	Identify workshop hand tool and equipment.
EQUIPMENT	Identify how to select tools for a particular task
CAM 112	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	Identify the following:
CAM 113	• 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	Identify general physical properties of metals
CAM 121	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
Counterbone 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
 Insufficient tip clearance Excessive lip clearance.
Calculate spindle revolution or cutting speed for specified size of drill using the formulae:-
N = 1000 S/ π d
1 10000/Au

$S = \pi dN/1000$
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 metals 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 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 of sheet metal tools Identify use of sheet metals for: • Welding • Soldering • Riveting
	 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	Identify simple basic machine
MECHANIZATION	Identify simple machine to agricultural machines
CAM 123	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	Identify the different sources of farm power
CAM 131	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	Identify the structural behaviour of plain carbon steel as it is heated from room temperature to about 1000°C
CAM 132	
	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	Identify PV system
CAM 211	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 DV surface according
	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	Identify primary and secondary tillage implements
CAM 212	Identify the various types of harrow and ploughs arrangement
CAIVI 212	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	Identify tools and machines for metal shaping operations.
CAM 213	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.
	rechtry the outling speed and rect with respect to futile 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
	Counterbank 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
	- onaping machines
	Carry out repairs and maintenance of lathe machine and other machines
TRACTOR AND ITS COMPONENTS	Identify tractor layout and its key elements.
CAM 221	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 minerer subcustom
	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
	A trach agricultural machinery and 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	Identify types of crop harvesting equipment
DAM 222	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
	I dentity types of forage narvesting 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
	curry out workshop and nord 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
TRACTOR AND ITS COMEONENTS II	

CAM 231	Identify functions of each tractor components
	Identify treater engine mente
	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	Identify types of transmission system
CAM 232	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	Identify the functions of the undercarriage system.
CAM 233	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.
	carry out stooring adjustment using the outside and outside instruments and wheel anglinheit 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
	• Kani
	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	Identify irrigation system components.
CAM 234	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
	identity 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	Identify tractor circuit diagram
CAM 311	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	Identify tractor circuit diagram	
CAM 312	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	Identify materials, tools and equipment for specific crop harvesting	
HARVESTING	Identify methods of harvesting	
CAM 313	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	Identify key factors influencing tractor selection	
CAM 321	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.	
	Ose digital tools to simulate machinery performance and senedule 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	Identify routine maintenance	
TROUBLESHOOTING OF TRACTORS		
CAM 322	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	Identify the components of a tractor tire	
CAM 323	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	Identify the operational principles behind GPS guidance, sensor integration, and variable rate application
AGRICULTURAL EQUIPMENT AND	systems.
MACHINES	
CAM 331	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
Α	ENGINE MAINTENANCE AND REPAIR TO	
	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

CURRICULUM AND MOUDULE SPECIFICATIONS IN AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANICS WORK CRAFT PRACTICE

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
В	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
С	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 EQUIPMEN	T (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
Ε	AGRICULTURAL WELDING EQUIPMEN	T (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 EQUIP	PMENT (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 ACCESS	ORIES
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	1 set
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
Н	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	РТО	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	Сгор	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
ſ	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
	water pump	L

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
Μ	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
Ν	TROUBLE SHOOTING AND MAINTEN	ANCE
	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
0	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
Р	SAFETY EQUIPMENT	
1	Hard Hats	6
2	Safety glasses	4
3	Earplugs	6
4	Steel-toed boots	2
5	First aid kits	4
0	ICT AND EDUCATIONAL EQUIPMENT	
1	Computers and Laptops	6
2	Projectors and Screens	4
2		4
2 3	Interactive whiteboards	6
3	Interactive whiteboards	
		6
3 4 5	Interactive whiteboards Agricultural software Educational Videos and DVDs	6 2
3 4 5	Interactive whiteboards Agricultural software	6 2
3 4 5 R	Interactive whiteboards Agricultural software Educational Videos and DVDs CROP PROCESSING EQUIPMENT	6 2 4
3 4 5 R 1	Interactive whiteboards Agricultural software Educational Videos and DVDs CROP PROCESSING EQUIPMENT Grain Dryers	6 2 4 6
3 4 5 R 2	Interactive whiteboards Agricultural software Educational Videos and DVDs CROP PROCESSING EQUIPMENT Grain Dryers Grain Cleaners	6 2 4 6 4
3 4 5 R 1 2 3	Interactive whiteboards Agricultural software Educational Videos and DVDs CROP PROCESSING EQUIPMENT Grain Dryers Grain Cleaners Seed Cleaners Oil extractors	6 2 4 6 4 6
3 4 5 R 1 2 3 4	Interactive whiteboards Agricultural software Educational Videos and DVDs CROP PROCESSING EQUIPMENT Grain Dryers Grain Cleaners Seed Cleaners	6 2 4 6 4 6
3 4 5 R 1 2 3 4 5	Interactive whiteboards Agricultural software Educational Videos and DVDs CROP PROCESSING EQUIPMENT Grain Dryers Grain Cleaners Seed Cleaners Oil extractors Milling machines	6 2 4 6 4 6
3 4 5 R 1 2 3 4 5 S 1	Interactive whiteboards Agricultural software Educational Videos and DVDs CROP PROCESSING EQUIPMENT Grain Dryers Grain Cleaners Seed Cleaners Oil extractors Milling machines Greenhouse or shade house	6 2 4 6 4 6
3 4 5 R 1 2 3 4 5 S	Interactive whiteboards Agricultural software Educational Videos and DVDs CROP PROCESSING EQUIPMENT Grain Dryers Grain Cleaners Seed Cleaners Oil extractors Milling machines	6 2 4 6 4 6

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