010 – AGRICULTURAL EQUIPMENT AND IMPLEMENT MECHANICS WORKS

EXAMINATION STRUCTURE

The trade consists of the following related courses:
191 – Metal Work
193 – Building/Engineering Drawing.

EXAMINATION SCHEME

11 – Agricultural Science, Implements and Machines

This subject grouping consists of two papers i.e. Papers I and II

11-1 – PAPER I : This will consists of two sections, viz Section A (Objectives) and Section B (Essay).
SECTION A: It will comprise of forty (40) multiple choice objective questions to be answered in 40 minutes. This section carries forty marks.
SECTION B: It will comprise of five Essay questions and students are to answer four questions in 2 hours. Each question carries 15 marks.

11-2 PAPER II: This will comprise of three compulsory practical questions for four (4) hours. This will attract 100 marks.

12 – Tractor Components ans System

This subject grouping consists of two papers i.e. Papers I and II

12-1 – PAPER I : This will consists of two sections, viz Section A (Objectives) and Section B (Essay).
SECTION A: It will comprise of forty (40) multiple choice objective questions to be answered in 40 minutes. This section carries forty marks.
SECTION B: It will comprise of five Essay questions and students are to answer four questions in 2 hours. Each question carries 15 marks.

12-2 PAPER II: This will comprise of three compulsory practical questions for four (4) hours. This will attract 100 marks.

011 – AGRICULTURAL SCIENCE IMPLEMENTS AND MACHINES (CAW 18 & 19)

S/N	TOPICS/OBJECTIVE	CONTENT	ACTIVCITIES/REMARK
1.	**History of Agriculture** 1. Trace the history of general agriculture and mechanized agriculture. 2. State the merit and demerit of agriculture, problems facing mechanized agriculture and possible solutions to the problems. 3. Explain in simple terms the Federal Government Policy on mechanized agriculture.	1. History of general agriculture which include: 2. Merit and demerit of mechanized agriculture. 3. Problems and possible solutions of mechanized agriculture. 4. Role of Federal Government on mechanized agriculture.	1. Compare traditional system of farming (Agriculture) with mechanized agriculture. Arrange visits to mechanized farms. 2. Discuss the meaning of agriculture and its practices which should include hunting and gathering, basic subsistence agriculture crop production and commercial agriculture with emphasis on mechanization. 3. The role of technology in the development of Agriculture.
2.	**Formation and Properties of Soil** 1. Define parent rock, its component and explain the mechanics of weathering. 2. Define soil structure, soil consistence, top soil, sub-soil and their components.	1. Parent rocks and its components. 2. Weathering. 3. Top soil, sub soil and their components, e.g. soil water, soil micro-organism and organic matter. 4. Composition of soil. 5. Texture and structure of soil.	1. Explain the factors that affect soil formation e.g. parent materials, climate topography, time and organic influences or biotic factors. 2. Discuss the physical chemical and biological agencies of weathering. 3. Draw soil profile. 4. stress the difference between soil structure and soil texture.
3.	**Types of Soil** 1. Identify classes of soil and discuss the effects of different types of soil on various types of agriculture machines. 2. Explain the effect of organic matter on soil and the effect of soil moisture on ploughing. 3. Draw the soil pH scale.	1. Classes of soil (clay, loam, silt, sandy soil) 2. Effects of different types of soil on agriculture machines. 3. Soil colour. 4. Effect of soil moisture on ploughing	1. Demonstrate to show that soil is made up of different particles. 2. Explain the effect of different types of soil on agricultural machines both during the dry season and wet season and effects of machines on different types of soil during dry and wet season. 3. Differentiate between acidic soil and alkali soil. 4. Explain the factors that cause soil acidity and the methods of removing soil acidity. (chemical e.g. liming and by mechanical e.g. construction of drainage channel)

S/N	TOPICS/OBJECTIVE	CONTENT	ACTIVCITIES/REMARK
			5. Explain the term pH and effect of soil acidity on soil and plant growth.
4.	**Soil Crop Relationship** 1. List the requirements for seed germination. 2. State the essential soil nutrients and their functions in the crops.	1. Effect of air, water, and temperature in seed germination. 2. The essential soil nutrients and their deficiency symptoms, Micro and Macro nutrients. 3. Functions of the trace and major elements in crop growth.	1. Discuss the effect of air, water, and temperature in seed germination. 2. demonstrate the effects of water, air and temperature in seed germination. 3. state the essential soil nutrients. 4. Draw nitrogen cycle and carbon cycle.
5.	**Plant Reproduction** 1. Explain the process of photosynthesis, respiration, fertilization and fruit formation. 2. Draw, label and explain the function of parts of flower.	1. The processes of photosynthesis and respiration. 2. The similarities and differences between photosynthesis and respiration. 3. Different parts of flower and their functions 4. Fertilization and fruit formation.	1. Discuss the processes of photosynthesis respiration and their role in plant reproduction. 2. List different parts of the flower and their functions. 3. Agents of fertilization. 4. Describe different stages of fruit formation.
6.	**Animal Husbandry** 1. Explain and identify the various species of animal of economic importance, their stages of growth and feed requiredments at each state. 2. Explain the type or housing required and equipment used in different animal houses.	1. Animal of economic importance, e.g. poultry (fowl, turkey) goat, sheep, rabbit, pigs and cattle. 2. The importance of balance diets, concentrate and maintenance ration in the growth and evelopment of animkals. 3. The types of housing requirements in various stages of animal growth. 4. Types and uses of equipment in different animals' houses.	1. Discuss the effects of different types of diets requirements in animal growth. 2. Explain the term associated with animal diet e.g. maintenance ration, production ration. Bnalanced diet and malnutrition. 3. Identify the materials needed in constructing different animal houses. 4. Demonstrate the construction of animals' house. 5. Demonstrate the uses of equipments in different animal houses, e.g. incubator, water tough etc. in poultry; spraying machine, tablet shooter etc. in cattle.
7.	**Safety at Work** 1. List sources of hazards in the workshop, describe and demonstrate first aid in case of minor injuries, electric shock and burns. 2. Demonstrate artificial respiration.	1. Sources of hazards in the workship e.g. handling and using hand tools, portable power tools and machine. i. Working with power tools ii. Working on the bench iii. Working on the field 2. Safety precaution while 3. First demonstrate first aid in case of minor accidents.	1. Discuss possible sources of hazards in the workshop. 2. List and discuss safety precautions in the workshop and on the field. 3. Demonstrate first aid application in case of minor injuries. 4. Demonstrate artificial

S/N	TOPICS/OBJECTIVE	CONTENT	ACTIVCITIES/REMARK
		4. Artificial respiration.	respiration.
8.	**Tools Storage** 1. Use and maintain common tools, identify and take care of measuring instruments. 2. Identify and take care of pullers, hydraulic press and different types of jacking and lifting equipment.	1. Identification of tools e.g. spanners, screw-drivers, drills, reamers, taps and dies, files, saws, chisels, and punches used for typical repair and maintenance work. 2. Maintenance and care of common tools. 3. Measuring instruments and their maintenance.	1. Identify the common tools and their uses 2. Display standard posters on each tools and storage bin. 3. Discuss the practices involved in taking care of these tools.
9.	**Tillage Implements** 1. Explain the working principles of disc harrow and carry out workshop and field adjustment field adjustment on ploughs, harrows, rotavators and ridgers. 2. Identify the various parts and types of harrow and plough arrangements. 3. Remove, inspect and replace worn out or damaged disc or blades on ploughs, harrows, rotavators and ridgers.	1. Tillage implements. 2. Types of Harrows and Plough arrangements e.g. single row, multi-row, straight etc. 3. Component parts of tillage implements.	1. Identify the main components of the tillage implement. 2. Demonstrate the working principles of tillage implements. 3. Inspection and replacement of component parts of tillage implements. 4. Identify various types of harrows and plough arrangement. 5. Display posters of disc harrow, ridgers and rotavators. 6. Workshop and field adjustment of tillage implements.
10.	**Planting Equipment** 1. Explain the working principles and operational adjustment of planting equipment. 2. Identify different types of planting equipment and couple and decouples them to a tractor.	1. Working principles of planting equipment. 2. Types of planting equipment and their component parts, e.g. grain-drill, grass drills, combine drills, seed planters and root crops planting equipment.	1. Examine and identify different types of planting equipment. 2. Carry out static and field calibrations on planting equipment. 3. Operational adjustment setting and checking of application rate. 4. Remove and replace worn out parts of planting equipment. 5. Coupling and decoupling of planting equipment to a tractor.
11.	**Fertilizer Applicators** 1. Operate and explain the principle of fertilizer applicators and manure spreaders. 2. Carry out maintenance, dismantle, assemble, replace or repair damaged or worn-out	1. The principle of fertilizer applicators and manure spreaders. 2. Component parts of fertilizer applicators and manure spreaders and their materials. 3. Maintenance of fertilizer applicators and manure spreaders. 4. Application rate of fertilizer applicator. 5. Operation of fertilizer applicators and	1. Describe the procedure involved in operating the manure spreader and fertilizer applicator. 2. Demonstrate the process involved in adjusting any replaced worn out parts of the fertilizer applicator. 3. Carry out static and field

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	parts on both fertilizer applicators and manure spreaders.	manure spreaders. 6. Dismantling, assemble, replacement and repairs of damaged parts.	calibration on fertilizer applicator. 4. Emphasize the care and maintenance of the fertilizer applicator before and after use.
12.	**Inter-row Machinery** 1. Explain the working principle of inter-row machinery. 2. Mount, use, dismount and replace worn out or damaged parts of inter-row machinery. 3. Differentiate between weeders and cultivators.	1. The working principle of inter-row machinery. 2. Inter-row steerage hoe, accessory and fitting. 3. Differences between weeders and cultivators. 4. Mount, use and dismount inter-row machinery from tractors. 5. Replacement and repair of worn out or damaged parts.	1. Explain the methods of operating inter-row machinery. 2. Display standard posters of inter-row machinery. 3. St ate the major differences between weeders and cultivators. 4. A visit to a mechanized farm.
13.	**Spraying and Dusting Equipment** 1. Operate, maintain and explain the working principles of spraying and dusting equipment. 2. Calibrate application rate for spraying and dusting chemicals and assemble or repair the worn out parts.	1. Working principle of spraying and dusting equipment. 2. Component parts of spraying and dusting equipment and their materials 3. Maintenance of spraying and dusting equipment. 4. Application rate for spraying and dusting equipment. 5. Operation of spraying and dusting equipment. 6. Dismantling, assembling or repair of damaged or worn out parts.	1. Describe with aid of sketches the working principles of different types of spraying and dusting equipment. 2. Identify component pars of spraying machines and dusters. 3. Carry out field and static calibration on spraying and dusting equipment. 4. Operation of spraying and dusting equipment. 5. Stress the necessary safety precautions in using the chemical. 6. Dismantle, assemble replace or repair damaged or worn out parts.
14.	**Mowers** 1. Describe different types of mowers and identify the parts of gearbox, cuter bar, flail, drum, knife assembly and pitman. 2. Explain the working principle and adjustment on the three common types of mowers, their routine maintenance and replacement of damaged and worn out parts.	1. Types of mowers. 2. The working principle of the three common types of mowers. 3. Component parts of mower with their materials. 4. Cutting knives and their cares. 5. Routine maintenance and adjustments of mowers. 6. Line diagram to show the various parts of mower.	1. Describe with the aid of sketches, the principle of the three common types of mowers. 2. Identify different types of mowers. 3. Discuss the operational and repair of these equipment. 4. Remove, sharpen, replace and adjust mowers' knife 5. Identify and examine the parts of gearbox. 6. Carry out routine maintenance and adjustment of mowers.

S/N	TOPICS/OBJECTIVE	CONTENT	ACTIVCITIES/REMARK
			7. Sketch out a line diagram to show the various parts of mowers.
15.	**Forage Harvesting Equipment** 1. Explain the working principle of Forage Harvester. 2. Identify, repair and adjust types of parts of forage harvesters.	1. Forage Harvester. 2. Types of component parts of Forage Harvester. 3. Operation of forage harvester. 4. Repair and adjustment of the parts, e.g knife assembly, conveyor, shear plate, reflector and gear box. 5. Correction of faulty operation of machine.	1. Describe with the aid of sketches, the working principle of the swath handling equipment. 2. Identify the component parts of swath handling equipment. 3. Carry out adjustments on harvesters.
16.	**Swath Equipment and Conditioning Equipment** Operate, Maintain, Service, adjust and repair or replace damaged or worn out parts of swath handling machine and condition machine.	1. Swath handling machine. 2. Component parts of Swath handling machine. 3. Routine maintenance and adjustment on the machine.	1. Describe with the aid of sketches, the working principles of the swath handling equipment. 2. Identify the component parts of swath handling machine. 3. Demonstrate routine maintenance and adjustment on the machines.
17.	**Maintenance and Operational Principles of Harvesting Equipment** 1. Describe the working principles, adjustments and operation of a combine harvester, potato digger, cotton picker, ground-nut lifter and other root crop harvesters. 2. Carry out routine maintenance and repair or replace worn out or damaged parts of the harvesters.	1. The working principles of the main components of harvesters e.g. Grain harvester, root crop harvester etc. 2. Operation and necessary workshop and field adjustment on all the harvesters. 3. Routine maintenance on the harvesters.	1. Discuss with sketches, the working principles of the main components of a combined harvester, potato digger, cotton picker, groundnut lifter and other root crop harvesters. 2. Explain the method of operating and adjusting the harvesters. 3. Remove and refit damaged parts of the harvesters. 4. Demonstrate routine maintenance on the harvester to avoid crops from being damaged.
18.	**The Working Principles of Dairy Machine and Maintenance** Service, maintain and explain the operational principle of dairy machine, milking machine, cream separator, cooling and storage machines.	1. Operational principle of dairy machine. 2. Servicing and maintenance dairy machine. 3. A visit to the Cattle Ranch.	1. Identification of milking machines. 2. Identification of components of milking and dairy machine. 3. A practical demonstration of the operations involved in using Dairy machine. 4. A visit to organized Cattle Ranch.
19.	**Operational Principles of Balers and Bale Collector**	1. Working principle of balers. 2. Servicing and maintenance of balers.	1. Identification of components of Balers.

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	1. Operate and identify parts of balers. 2. Explain the working principles of balers, the repairs and adjustment of pick up mechanism, packer assembly, ram assembly, knife and shear plates and tying mechanism.	3. Operational principles of balers.	2. Practical demonstration of the operations involved in using balers. 3. Adjustment of pick up mechanism, packer assembly, ram assembly, knife and shear plates.
20.	**Safety at Work** 1. List sources of hazards in the workshop, describe and demonstrate first aid in case of minor injuries, electric shock and burns. 2. Demonstrate artificial respiration.	1. Sources of hazards in the workshop, e.g. handling and using hand tools, portable power tools and machine. 2. Safety precaution while working: i. with power tools; ii. on the bench; iii. on the field. 2. First aid applications in case of minor accidents. 3. Artificial respiration.	1. Discuss possible sources of hazards in the workshop. 2. List and discuss safety precautions in the workshop and on the field. 3. Demonstrate first aid application in case of minor injuries. 4. Demonstrate artificial respirat
21.	**Hitches** 1. State the working principles of hitches in a transmission system. 2. Explain the purpose of alternative linkage position and carry out operation adjustments. 3. Identify types of top links and stabilizers and different types of draw bars. 4. Carry out routine maintenance of hitches and attachments and make simple line diagrams of hitches.	4. Principles of hitches in a transmission system. 5. Purpose of alternative linkage position. 6. Top links and stabilizers. 7. Different types of draw bars: i. Channel ii. Solid iii. Tubular draw bars 8. Maintenance routine of hitches and attachment.	1. State the working principle involved and purpose of alternative linkage position of hitches in a transmission system. 2. Identify different types of top links and stabilizers. 3. Sketches of hitch arrangements.

012 – TRACTOR COMPONENTS AND SYSTEM, (CAW 13, 20 & 21)

S/N	TOPICS/OBJECTIVE	CONTENT	ACTIVCITIES/REMARK
1.	**Tractor** 1. Describe the conventional layout of tractor unit component, and the layout of a motor vehicle. 2. List the different types of cabs and safety frames, select and replace various types of components mounting in tractor and vehicle units. 3. Differentiate between the layout of tractor and motor vehicle unit and attach agricultural machinery units to tractor and vehicle. 4. Operate tractor and vehicle to carry out road tests, remove and mount cabs on tractors and vehicle. 5. Identify the types of cabs and carry out appropriate road test before and after test.	1. Conventional layout of tractor unit components: power unit, transmission unit, under carriage, final drives etc. 2. Conventional layout of a major vehicle. 3. Types of cabs and safety frames. 4. The types of components mounting in tractor and vehicle units. 5. Couple and uncouple agricultural equipment. 6. Attachment of agricultural machinery units to tractor and vehicle e.g. harrows, ploughs, mowers, differs, ridgers etc. 7. Operations of tractor and vehicle to carry out road tests. 8. Methods of removing and mounting cabs on tr5actors and vehicles. 9. Types of cabs: gungle cab, canopy rain protector, sun protector. 10. Road test before and after repair work.	1. Identify the conventional layout of tractor unit components e.g. power unit, transmission unit, under carriage, final drives and suspension. Explain the uses of each unit. 2. Display standard posters of tractor unit components, power unit, transmission unit and final drives. 3. Identify the types of cab units and their safety frames. 4. Demonstrate how to couple agricultural equipment to tractors and vehicle 5. Emphasize the safe working condition during coupling and decoupling of implements and equipment to tractors and vehicles and mounting of cabs. 6. Demonstrate the operation of tractor and vehicle to carry out road test. 7. Demonstrate the removal and mounting of cabs on tractors and vehicles. 8. Carry out appropriate road test both before and after repair work.
2.	**General Layout and Principles of Internal Combustion Engine (ICE)** 1. Discuss the layout of an internal combustion engine and identify the materials used, their components and reasons for their use. 2. Explain the principle of two stroke and a four stroke cycle engines and differentiate between direct and indirect injection system. 3. Carry out valve timing, injection timing and interpret measurement and compression reading	1. Layout of an internal combustion engine. 2. component parts of internal combustion engine. 3. Working principle of two stroke and a four stroke cycle engines. 4. Direct and indirect injection system. 5. Compression ignition engine. 6. Materials used for component parts of internal combustion engine and reasons for their use. 7. Valve timing and ignition timing. 8. Compression ratio, compression pressure and its measurement relative to internal combustion engines.	1. Identify the layout of an internal combustion engine. 2. Draw some parts of engine and emphasize the importance of two stroke and a four stroke cycle engines. 3. State and demonstrate the working principle of two stroke and a four stroke cycle engines. 4. Stress the difference between two and four stroke engines. 5. Explain the difference between direct and indirect injection system.

S/N	TOPICS/OBJECTIVE	CONTENT	ACTIVCITIES/REMARK
	relative to power unit. 4. Inspect parts for wear and damage and repair or replace valves.		6. Discuss the terms: compression ignition, spark ignition, compression ratio and compression pressure as applied to internal engine combustion. 7. Display posters on compression ignition engines and their component parts. 8. State the principles involved in dismantling an engine, inspect parts for wear and damage and replacement of valve, seat and grinding of valve face and the method of reassembling them correctly. 9. Emphasize the use of valve grinding tools, valve spring compression, feeler gauges etc. 10. Identify materials used for component parts manufacture e.g. brass, rubber, plastic, Aluminium, cast iron etc. 11. Measurement of valve spring pressure.
3.	**Fuel System** 1. Explain the working principles of petrol and diesel fuel system and locate the various components of the fuel system. 2. Identify different types of filter and differentiate between petrol and diesel fuel system. 3. Trace out faults, clean or replace new fittings, test injectors and repair or replace fuel gauges.	1. The working principles of petrol and diesel fuel system. 2. Fuel systems (petrol and diesel engine) engine. 3. Working principles of the fuel lift pump, in line and distributor injection pumps, filters, injectors, governors and cold starting aid. 4. Types of filters e.g. oil bath, dry element types and pre-cleaners.	1. Identify different types of fuel system. 2. Display posters of various fuel systems. 3. Identify the properties of petrol and diesel fuel system. 4. Discuss safety hints on the fuel system. 5. Describe the procedure involved in removing fuel lift pump, filters and the adjustment of governors. 6. Remove, dismantle and reassemble the fuel lift pumps, filters, injectors and fuel gauge. 7. Emphasize the importance of fault finding methods with appropriate sequence to repair work in all the topics in this modules.
4.	**Carburation** 1. Explain the principles of	1. Working principles of carburetor. 2. Different designs of carburetors e.g.	6. Discuss the working principles of carburetor.

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	carburetion and the purpose of diaphragm in a carburetor. 2. Identify the different designs of carburetors and differentiate between the fixed and variable choke carburetors. 3. Remove, clean and replace carburetor, fuel pump and air filter. 4. Adjust idle speed and fuel mixture.	Solex, Zenith, S. U. Carburetors. 3. Difference between the variable and fixed choke carburetors. 4. Purpose of diaphragm in a carburetor. 5. Idle speed and fuel mixture.	7. State the different designs of carburetors and draw their sketches. 8. Emphasize the difference between variable and fixed choke carburetors. 9. Clean and assemble carburetor fuel pump and air filters. 10. Discuss methods of removing, dismantling cleaning, assembling and replacement of carburetors.
5.	**Diesel Injection System** 1. Identify and explain the working principles of Diesel Injection System. 2. Service fuel filters and injectors. 3. Time an injection pump to an engine and remedy diesel injection faults.	1. Principle of fuel injection. 2. Component parts of diesel injection system. 3. Working principles of different types of injection pumps. 4. Remedy diesel injection faults e.g blockages, leakages and bleeding.	1. Describe the principle involved in diesel injection system. 2. Identification of component parts of diesel injection system. 3. Discuss methods involved in servicing, testing and replacement of component parts of diesel injection system. 4. Identify different types of injection pumps. 5. Give safety hints on the injection system. 6. Identify and remedy diesel injection fault e.g. blockage, leakages and bleeding. 7. Identification, servicing and repair faulty fuel gauges.
6.	**Cooling System** 1. Explain the principles of cooling systems and the functions of the pressure cap. 2. Solder a leaking radiator and rectify all air and liquid cooling system problems. 3. Flush the cooling system to get rid of sludge, oil, etc. and test thermostat for correct operating temperature. 4. Draw the disposition of the pressure cap operation.	1. Principles of cooling system. 2. Liquid cooling systems and their problems e.g. over-heating and over-cooling. 3. Air cooling system and their problems e.g. fins and blockage etc. 4. Cleaning of the cooling system. 5. Thermostat in cooling system, e.g. bellow type, wax pellet type etc. 6. Functions of the pressure cap.	1. Demonstrate the working principles of cooling systems when in operation. 2. Identify and sketch component different cooling system. 3. Remove, dismantle and assemble water pumps.
7.	**Lubrication** 1. Identify different types	1. Different types of lubricating system, e.g. splash, pressure feed and splash and	1. Describe different types of lubricating system, splash,

S/N	TOPICS/OBJECTIVE	CONTENT	ACTIVCITIES/REMARK
	of lubricating systems and lubricating oil filters. 2. State the factors affecting oil deterioration and carry out oil changing and replacement of oil filter. 3. State the various types of oil, their viscosities and explain the effect of oil thickness on lubrication. 4. Repair faults on the lubricating systems.	full pressure-feed. 2. Component parts of different lubricating systems. 3. Lubricating oils. 4. Factors affecting oil deterioration.	pressure-feed and splash and full pressure feed. 2. Inspect samples of various lubricants. 3. Describe their characteristics. 4. Compare fresh and used engine oil based on colour, texture and viscosity. 5. Cleaning of oil filters and oil strainers. 6. Remove and refit the oil gauge and check for oil leakages.
8.	**Steering System** 1. Explain the working principles and remove, dismantle, assemble and install steering boxes. 2. Carry out steering angle adjustment, diagnose and rectify faults in steering boxes. 3. Carry out routine maintenance of steering system.	1. The working principle of steering systems. 2. remove and refit steering boxes. 3. Adjustment of steering angle by the use of castor and camber instruments and wheel alignment gauge. 4. Maintenance of steering system.	1. Describe with the aid of sketches different types of steering mechanisms. 2. Identify and list components of steering boxes. 3. Display standard poster of steering system. 4. Sketch as many of the main components of steering boxes and also positions of various components. 5. Remove and replace steering component parts. 6. Adjustment of steering wheel free play and angles by the use orf castor and camber angle, adjusting instruments and wheel alignment gauge. 7. Maintenance of steering systems.
9.	**Suspension System** 1. Explain the working principles of the suspension system and identify types of springs. 2. Identify the different types of wheels, rims and tyre ply-ratings and remove, disassemble, assemble and install suspensions. 3. Change worn or damaged parts of the suspension.	1. The working principles of solid, liquid and pneumatic suspensions. 2. Types of spring e.g leaf springs, torsion bar, coil spring and rubber spring. 3. Wheels and Tyres.	1. Identify and sketch the various component parts of a suspension system. 2. Sketch out of a suspension system. 3. Examine the working principle of solid, liquid and pneumatic suspensions. 4. Explain functions of wheels and tyres. 5. Discuss the importance of tyre types and ply-rating and inflation pressures on tyre life. 6. Examine and disassemble suspensions, repairs tyres

S/N	TOPICS/OBJECTIVE	CONTENT	ACTIVCITIES/REMARK
			and tubes.
10.	**Hydraulic System** 1. Identify parts of Hydraulic system and examine the principles of hydraulic system. 2. Remove, service and install pump, remove and discard used seals and install new ones and valves.	1. Hydraulic system. 2. Main component parts of hydraulic system. 3. Cleaning and installation of pump.	1. Describe with sketches the working principles of hydraulic system. 2. Examine the various parts of hydraulic system. 3. Display posters of hydraulic system.
11.	**Braking System** 1. Examine the working principle of the overhaul, remove, install, dismantle and assemble braking system. 2. Carry out routine maintenance, change parts and inspect. 3. Identify and maintain pneumatic braking system and carry out efficiency test.	1. The working principles of braking system. 2. Component parts of braking mechanism. 3. Removal and refit of the braking system and brake pads and also inspection of the brake drum. 4. Efficiency test of braking system.	1. State the principle involved in braking systems. 2. Identify component parts of different braking mechanism. 3. Spot-test or drive-test brakes for effectiveness. 4. Explain with the aid of sketches, the functions of component parts of a brake mechanism. 5. Dismantle, assemble, adjust and test brake mechanism. 6. Explain the safety precaution involved while working with braking systems.
12.	**The Theory of Wet and Dry Cell Batteries** 1. Maintain, connect and mix electrolyte and fill into the battery cell taking necessary precautions. 2. Explain the construction of the battery and test the specific gravity and voltage of a battery. 3. Connect the battery correctly to the battery charge.	1. Wet and dry cell batteries. 2. Battery component and material used. 3. Electrolytes.	1. Discuss the uses and construction of lead acid battery. 2. Mix electrolytes to the correct specific gravity. 3. Demonstrate the filling of electrolyte into battery cells. 4. Explain how to test specific gravity and voltage of a battery. 5. Demonstrate the correct method of connecting electrical cable to battery terminal. 6. Stress the importance of using wet cell batteries over dry cell batteries. 7. Care and maintenance of battery.
13.	**Starting Circuit System** 1. Identify the components of a starter motor and	1. The components of a starter motor. 2. Simple complete wiring circuits. 3. Servicing a starter motor.	1. Identify component parts of starter motor. 2. Demonstrate methods oif

S/N	TOPICS/OBJECTIVE	CONTENT	ACTIVCITIES/REMARK
	trace faults. 2. Draw simple complete wiring circuit and disassemble, service a starter motor and replace faulty or worn parts. 3. Trade and rectify simple wiring faults.	4. Wiring faults and remedies	replacing faulty parts of a starter motor and their functions. 3. Display posters of the component parts of a starter motor and simple complete wiring circuits. 4. Remove and refill a starter motor and worn out parts. 5. Rectify wiring circuit faults.
14.	**Generator and Regulations** 1. Dismantle and identify alternator and dynamo parts and trace out faults. 2. Rectify, replace and adjust cut out relays and voltage regulator.	1. Alternators and dynamos. 2. Component parts of alternators and dynamos. 3. Adjusting voltage regulators. 4. Carry out systematic fault finding and correction.	1. Working principle of alternators and dynamos. 2. Display standard posters of alternators and dynamos. 3. Identify component parts and their functions. 4. Dismantle and reassemble alternators and dynamos. 5. Carry out systematic fault finding and correction. 6. Adjust voltage regulators. 7. Check charging systems for correct voltage and current.
15.	**Ignition System** 1. Explain the operation of the ignition parts and components and trace correct faults in the circuit. 2. Adjust ignition timing and explain the operators of the advanced mechanism.	1. The operation of the primary and secondary windings of ignition coil, distributors, contact breaker points, condenser and spark plugs. 2. Fault finding in the ignition circuits. 3. Ignition timing. 4. Operation of a vacuum and centrifugal advance mechanism.	1. Discuss with the aid of sketches the operation of a coil ignition system. 2. Demonstrate the method of adjusting ignition timing using a timing light. 3. Explain the functions of component parts of coil ignition system.
16.	**The Working Principle of Clutch** 1. Diagnose fault by inspection and remove, dismantle/assemble clutch. 2. Set spring pressure and rest spring compression and repair or replace worn oir damaged parts. 3. Identify different types of tools used and explain the principles of clutch operation. 4. Identify different types of clutches and make simple line diagram or clutch components.	1. Principle of clutch operation (single disc, multiple disc, wet disc etc.) 2. Application of clutches iun power transmission of tractors, vehicles and agricultural machines. 3. Component parts of clutches and material for their manufacture (i.e. disc and frictional materials). 4. Simple line diagram of clutch components.	1. Describe with aid of sketches the operation of different clutches. 2. Identify equipment, machines and power transmission unit where clutches are employed. 3. Display standard poster of clutch and drive components. 4. Identify component parts of clutches. Dismantle, inspect component parts and assemble clutches. 5. Carry out adjustment on clutches using appropriate tools (i.e. clutch free play). 6. Display standard posters of

S/N	TOPICS/OBJECTIVE	CONTENT	ACTIVCITIES/REMARK
			tractor unit components, power unit, transmission unit and final drives.
17.	**The Working Principle of Bearing in a Transmission System** 1. Explain the functions of hearing in transmission system and the effect of friction and lubrication on moving parts. 2. Identify different types of bearing and types of transmission oil and grease. 3. Draw simple line diagram of a bearing and inspect visually for wear and replace worn-out bearings.	1. Bearings and their functions in transmission system. 2. The effect of friction and lubrication on moving parts. Types of bearing e.g. ball bearing, roller bearings, shell bearing and bushing. 3. Types of transmission oil and greases. 4. Simple line drawing of a bearing transmission system. 5. Simple line drawing of a bearing transmission system. 6. Visual inspection of war and replacement of worn bearings.	1. Discuss the roles of bearing in transmission system. 2. Display posters of a bearing in a transmission system. 3. Explain the properties and functions of lubrication on moving parts. 4. Mention the common types of bearing, transmission oil and greases. 5. Demonstrate the method of cleaning, inspecting and removal of worn bearings.
18.	**Types of Seals used on Tractors and Vehicles.** 1. Identify different types of seals remove and replace damaged and or worn out seals. 2. Cut gaskets of all shapes and sizes and identify different types of gasket materials and where they are used.	1. Types of seal, e.g. metallic, non metallic, 'O' ring seals, gasket, dust excluders, sealing ring lubricant boots. 2. Replacement and removal of damaged and worn out seals. 3. How to cut gasket of all shapes and sizes. 4. Types of gasket materials – cork, paper and felt.	1. Show different types of seals that exist. 2. Demonstrate the replacement of damaged or worn out seals. 3. Cutting and fitting gaskets and mention different types of gasket materials e.g. cork, paper and felt.
19.	**Working and Operating Principles of Cams and Ratchets** 1. Explain the working principle of cams and ratchets and identify where they are used. 2. Identify different types of cams and ratchet.	1. The working principle of cams and ratchets and where they are used. 2. Types of cams and ratchets - simple cams, variable cams, lobe, ratchet and ratchet feeds etc.	1. Demonstrate the working principles of cams and ratchets. 2. Discuss different types of cams and ratchets and where they are used. 3. Service cams and ratchets.
20.	**The Working Principles of Drives and Coupling** 1. Identify types of dr4ives, remove and replace damaged or worn out part. 2. Sketch simple line diagram and adjust drives and couplings.	1. Transmission elements e.g. tubular and solid shaft, keyways and key fits, universal shafts and joints, hubs and driving flanges, gear, sprocket, chain and pulley drives. 2. Materials used for production of transmission elements. Methods of removing and replacing damaged or worn out parts.	1. Identify different types of transmission elements. 2. Examine the main components of drives. 3. Examine worn out parts in the drives. 4. Carry out adjustment on different types of drives e.g. belt drives etc. 5. Service hubs and bearing arrangements.
21.	**Gear Boxes** 1. Explain the arrangement	1. Gear boxes used in tractors, vehicles and agricultural machines.	1. Describe with the aid of sketches the principles of

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	of gears in the gear boxes. 2. Diagnose faults by inspection of testing. 3. Select the various tools and equipment used for working on the gearbox and remove gear box from a vehicle. 4. Dismantle, inspect for wear, check and fill the oil level in a gear box with correct oil grade.	2. Component parts of gear boxes. 3. Gear oils and their uses. 4. Faults diagnose. 5. Tools and equipment used for various jobs on a gear box. 6. Ways of removing gear box from a vehicle. 7. Methods of inspecting gear teeth, bushings, shafts and assembling of the gear box.	operation of common gear boxes used on tractors, vehicles and agricultural machines. 2. Determine the gear ratio by practical method. 3. Examine various types of equipment used for various jobs in a gear box. 4. Remove and refit gear busing, shaft and the gear box. 5. Identify different grades of oil. 6. Mention lubrication requirement e.g. suitable viscosity preferably constant, high film strength, oiliness to ensure adherence etc. 7. Dismantling and reassembling of gear boxes.
22.	**Hydraulic System** 1. Explain the working principle of the hydraulic system. 2. Identify the various parts of the hydraulic system on a tractor, diagnose and rectify faulty linkage operations. 3. Identify and use different types of hydraulic hoses and couplings. 4. Identiry part of hydraulic system. 5. Remove service and install pump, remove and discard used seals and install new ones and valve.	1. The working principle of the hydraulic systems. 2. Component parts of the hydraulic system on a tractor, pump, control valves, pistons, reservoirs and filters. 3. Linkage operations and faulty diagnosis. 4. Different types of hydraulic hoses and coupling and their uses. 5. Hydraulic system. 6. Main component parts of hyudraulic system. 7. Cleaning and installation of pump.	1. Describe the working principles of hydraulic system. 2. Examine various parts of the hydraulic system on a tractor. 3. Identify different tyupes of hydraulic hoses and couplings. 4. Emphasize the importance of hydraulic hoses and couplings, valves, filters, and safety precautions to be observed when working with high pressure system. 5. Describe with sketches and working principle of hydraulic system. 6. Examine the various parts of hydraulic system. 7. Diusplay poster of hydraulic system.
23.	**Differentials and Final Drive** 1. Explain the working principles of a differential and final drives units. 2. Diagnose faults by inspection or road testing and remove differential and final drives.	1. Principles of differential and final drives unit. 2. Systematic fault diagnosis. 3. Ways of removing and assembling the differential assembly. 4. Adjustment of backlash and other clearance on differential and final drives. 5. Principles of differential lock. 6. Diagram of differential and final drives.	1. Describe the procedure involved in operating differential and final drives unit. 2. List possible causes of wear. 3. Display standard posters of differential and final drives.

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	3. Dismantle, inspect the components and check, adjust backlash and other clearance. 4. Explain the working principle of a differential lock and make simple line diagram of differential and final drives.		4. Inspect the gear teeth or sprockets of wear.
24.	**Power Take Off (PTO)** 1. Explain the working principle of a PTO and identify the types of PTO drives. 2. Disassemble, inspect gears shaft wear and assemble PTO Unit. 3. Carry out routine maintenance and remove or replace damaged and worn out parts. 4. Make simple line diagrams of PTO units to show independent and ground speed drives.	1. Principle of a PTO. 2. Types of PTO drives (independent and live PTOs) 3. Assemble PTO unit gears and shaft. 4. Maintenance and replacement of damaged and worn out parts. 5. Sketches of PTO units.	1. Identify different types of PTO. 2. Discuss the maintenance practices and replacement of damaged parts or worn out parts. 3. Sketches of PTO drive unit.
25.	**Safety at Work** 1. List sources of hazards in the workshop, describe and demonstrate first aid in case of minor injuries, electric shock and burns. 2. Demonstrate artificial respiration.	1. Sources of hazards in the workship e.g. handling and using hand tools, portable power tools and machine 2. Safety precaution while working: a. With power tools b. On the bench c. On the field 3. First demonstrate first aid in case of minor accidents. 4. Artificial respiration.	1. Discuss possible sources of hazards in the workshop. 2. List and discuss safety precautions in the workshop and on the field. 3. Demonstrate first aid application in case of minor injuries. 4. Demonstrate artificial respiration.
	Tools Storage 1. Use and maintain common tools, identify and take care of measuring instruments. 2. Identify and take care of pullers, hydraulic press and different types of jacking and lifting equipment.	1. Identification of tools e.g. spanners, screw-drivers, drills, reamers, taps and dies, files, saws, chisels, and punches used for typical repair and maintenance work. 2. Maintenance and care of common tools. 3. Measuring instruments and their maintenance.	1. Identify the common tools and their uses 2. Display standard posters on each tools and storage bin. 3. Discuss the practices involved in taking care of these tools.