THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATION COUNCIL OF TANZANIA

ADVANCED CRTIFICATE OF SECONDARY EDUCATION EXAMINATION

134/1 **AGRICULTURE 1**

(For Both School and Private Candidates)

Time: 3 Hours. **ANSWER** **Year: 2019**

Instructions

1. This paper consists of sections A, B and C with total of **nine (9)** questions.
2. Answer **three** questions in sections A and **one (1)** question from each section B and C.
3. Section A carries **60** marks and section B and C carries 20 marks each.
4. Cellular phones and unauthorized materials are **not allowed** in the examination room.
5. Non-programmable calculators may be used.
6. Write your **Examination Number** on every page of your answer booklet(s).

1. (a) Name the engine component which convert reciprocating motion to rotary motion.

The crankshaft is the engine component that converts the up and down reciprocating motion of the pistons into continuous rotary motion that can be transmitted through the drivetrain to do useful work.

(b) Identify eight systems which are commonly found on a tractor engine and give a function for each.

The fuel system stores, filters, and delivers fuel to the engine at the correct rate and cleanliness, ensuring a combustible air fuel mixture reaches the combustion chamber or, in a diesel, that high pressure fuel is injected for ignition.

The air intake system admits, cleans, and meters air into the engine, typically using an air filter to remove dust and a manifold to distribute air evenly to each cylinder so that combustion is efficient and complete.

The lubrication system circulates oil under pressure to bearings, pistons, and valve gear, forming a protective film that reduces friction, carries away heat, and flushes out wear particles to prolong engine life.

The cooling system removes excess heat generated by combustion and friction, using coolant flow through water jackets, a thermostat to regulate temperature, and a radiator and fan to dissipate heat to the atmosphere.

The ignition system, in petrol engines, generates and times high voltage sparks to ignite the air fuel mixture, converting low battery voltage into controlled high voltage delivered to each spark plug at the correct crank angle.

The exhaust system channels spent gases safely away from the engine, reduces noise with a silencer, and manages back pressure so that cylinder scavenging remains effective without excessive pumping losses.

The starting and charging system cranks the engine to its self running speed using a starter motor, then maintains electrical power during operation through an alternator and voltage regulator that keep the battery charged and accessories powered.

(c) Briefly describe the operations of petrol and diesel fuel engines.

The operation of a petrol engine is based on premixing fuel and air, compressing this mixture in the cylinder, and igniting it at the right moment with an electric spark, where flame propagation raises pressure that pushes the piston down to produce power.

The operation of a diesel engine is based on compressing only air to a high pressure and temperature, then injecting diesel fuel that atomizes and self ignites on contact with the hot compressed air, producing rapid pressure rise and the power stroke without an external spark.

(d) Outline the function of each of the following components of battery ignition system in a petrol fuel engine: (i) coil (ii) distributor (iii) condenser (iv) spark plug and (v) battery.

The ignition coil stores energy magnetically when low voltage current flows through its primary winding, then releases that energy as a high voltage pulse in the secondary winding when the primary current is abruptly interrupted.

The distributor times and routes the high voltage from the coil to each cylinder in the firing order, using a cam and breaker or an electronic trigger and a rotor that passes near contacts leading to the spark plug leads.

The condenser, also called a capacitor in breaker point systems, absorbs the sudden collapse of current when the points open, preventing arcing across the points and ensuring a rapid magnetic field collapse for a strong high voltage pulse.

The spark plug receives the high voltage and produces a controlled spark across its gap inside the combustion chamber, igniting the compressed air fuel charge so that combustion begins reliably at the desired crank angle.

The battery provides the low voltage electrical energy needed to power the starter motor during cranking and to energize the ignition primary circuit before the alternator takes over, stabilizing system voltage and supplying current to all electrical loads.

2. (a) (i) give the meaning of the term protective gears as used in farm workshop (ii) describe five protective gears used in the farm workshop (b) (i) suggest three main safety precaution to be considered in farm workshop (ii) briefly explain the use of fire extinguisher in the farm workshop (c) account for six factors to be considered when siting a farm workshop.

Protective gears in a farm workshop refer to the clothing, devices, and equipment worn or used by workers to reduce the risk of injury, accidents, or exposure to harmful conditions while carrying out farm or mechanical tasks. They are essential in ensuring personal safety when working with machines, tools, chemicals, and other hazardous materials.

Safety boots are one of the protective gears used in a farm workshop. They protect the feet from heavy objects falling, sharp items on the floor, and slipping on oil or water surfaces. The reinforced toe cap provides additional safety against crushing injuries.

Overalls or protective clothing are also vital. They shield the body from dirt, oil, chemical spills, and sparks from welding. They also reduce the risk of clothes getting caught in moving parts of machines, thus preventing serious injuries.

Goggles are used to protect the eyes from dust, chemical splashes, and sparks during cutting, welding, or grinding operations. They are crucial because eye injuries are often severe and sometimes permanent if proper protection is not used.

Gloves are another important gear. They protect the hands from cuts, burns, chemical exposure, and abrasions when handling sharp or rough tools, hot objects, or corrosive substances. They also provide a better grip when working with equipment.

Ear protectors or ear muffs are essential in workshops with noisy machines. They prevent hearing damage or loss caused by continuous exposure to high noise levels, thus ensuring long-term ear health.

One major safety precaution in a farm workshop is maintaining cleanliness and orderliness. Tools and equipment should be kept properly after use to prevent tripping, accidents, or delays when searching for tools.

Another precaution is ensuring that machines and tools are regularly serviced and checked before use. Well-maintained machines reduce the risk of breakdowns and accidents during operation.

A third precaution is providing proper training and supervision for workers. Workers should know how to handle equipment correctly and follow safety guidelines to prevent accidents.

A fire extinguisher in a farm workshop is used to control and put out small fires before they spread. It works by cutting off oxygen supply or cooling down the flames, depending on the type of extinguisher. Having one within reach ensures that fire hazards are managed quickly, protecting lives and property.

When siting a farm workshop, accessibility is an important factor. The workshop should be located where it is easy for workers and equipment to reach, preferably near the farm operations.

The availability of electricity and water supply is also important since many workshop activities require power tools and cleaning of machines.

Another factor is proper drainage and waste disposal. The site should allow water and oil to drain away without causing stagnant pools or contamination.

Proximity to farm machinery and storage areas should also be considered to reduce time wasted in transporting machines for repair or servicing.

The workshop should be sited in a well-ventilated area to allow fumes and smoke to escape, ensuring the safety and health of workers.

Finally, security is important. The site should allow the workshop to be locked and protected from theft or vandalism since valuable tools and machines are often kept there.

3. (a) Differentiate (i) concrete block and mud brick (ii) concrete and mortar (iii) foundation and footing

Concrete block is a building unit made from a mixture of cement, sand, gravel, and water which is molded and hardened to form strong blocks suitable for durable structures. Mud brick, on the other hand, is made by mixing clay or soil with water and sometimes straw, then molding it into shape and sun-drying it. Unlike concrete blocks, mud bricks are less durable, absorb water easily, and are prone to cracking.

Concrete is a hardened mixture of cement, sand, aggregate, and water used in construction to form strong structural elements such as beams, slabs, and columns. Mortar is a mixture of cement, sand, and water without coarse aggregates, used mainly as a binding material to hold bricks, blocks, or stones together in construction.

Foundation is the base part of a structure that transfers the load of the building to the ground, ensuring stability and strength. Footing is a specific part of the foundation that spreads the load over a wider area of soil, providing support to prevent sinking or tilting of the structure.

(b) Briefly explain three factors influencing the design of farm structures

One factor influencing the design of farm structures is the purpose of the structure. The design must suit the intended use, whether for crop storage, livestock housing, water harvesting, or machinery storage, as each purpose requires different space, ventilation, and durability features.

Another factor is the climatic condition of the area. In hot regions, designs must allow proper ventilation and cooling, while in cold or wet areas, insulation and waterproofing are necessary to protect crops, animals, or equipment.

The third factor is the availability and cost of construction materials. Designs often depend on whether local materials like timber, mud, and stones are available, or if more durable but expensive materials like concrete and steel can be afforded.

(c) Enumerate six features of a good storage structure

A good storage structure should be well-ventilated to allow free circulation of air, preventing mold growth and spoilage of stored crops.

It should be moisture-proof so that rainwater or dampness does not seep in, which would damage stored products.

It should be rodent-proof and insect-proof to protect the stored materials from pest infestation and loss.

The structure should be durable, made from strong and long-lasting materials to withstand weather and frequent use.

It should also be spacious enough to accommodate the expected quantity of produce or materials to be stored without overcrowding.

Finally, it should be secure, with lockable doors and protection against theft and unauthorized access.

(d) Suggest five farm structures and for each give its importance to farmers

A granary is a common farm structure used for storing harvested grains safely, preventing losses due to pests and weather.

A cattle shed provides shelter for livestock, protecting them from harsh weather, diseases, and predators, while also making management easier.

An irrigation canal is a farm structure that delivers water to crops efficiently, ensuring proper growth and high yields in areas with unreliable rainfall.

A fence is an important farm structure for marking boundaries, preventing animals from straying, and protecting crops from damage.

A water tank is a storage structure for collecting and storing water, ensuring farmers have a reliable supply for domestic use, irrigation, and livestock.

4. (a) Compare a seed drill with a planter

A seed drill is a machine used for sowing seeds at uniform depth and spacing, usually for small grains like wheat, millet, or sorghum, and it covers the seeds with soil immediately. A planter, on the other hand, is designed for larger seeds such as maize, beans, or sunflower, and it places them precisely at predetermined intervals with greater spacing accuracy compared to the seed drill.

(b) Briefly explain seven functions of the seed drill components

The hopper holds the seeds before they are delivered to the soil, ensuring a continuous supply during sowing.

The seed metering device regulates the flow of seeds from the hopper to the furrows, preventing wastage or overseeding.

The seed tubes guide the seeds from the metering device to the furrow opener without scattering.

The furrow openers cut through the soil to create narrow channels where the seeds are deposited.

The covering device pushes soil back over the seeds after deposition, ensuring they are properly buried.

The frame provides structural support and holds all the components of the seed drill together.

The transport wheels provide mobility and traction, and in many designs, they also drive the metering mechanism.

(c) Elaborate four functions of double mouldboard plough

A double mouldboard plough inverts the soil to bury crop residues and weeds, enhancing decomposition and soil fertility.

It helps in breaking up compacted soil layers, improving aeration and root penetration.

The plough also incorporates organic matter into the soil, enhancing soil structure and nutrient content.

It facilitates the creation of ridges and furrows suitable for planting row crops and improving water infiltration.

(d) Briefly describe the mode of operation performed by a combine harvester

A combine harvester performs three main operations in one pass: reaping, threshing, and winnowing. It cuts the crop, separates the grain from the stalks and husks, and then cleans the grain, collecting it in a tank while discharging the straw and chaff onto the field.

5. (a) Enumerate three equipment used to carry out overhead irrigation at the home garden

A garden hose with a spray nozzle is commonly used to distribute water over the crops in a fine spray.

Sprinklers are fixed or movable devices that distribute water over a large area by rotating or spraying.

A watering can is a simple hand-operated container with a perforated spout used for small-scale irrigation.

(b) Explain the following surface irrigation methods (i) free flooding (ii) checks (iii) boarders (iv) basin (v) furrow

Free flooding is a method where water is allowed to flow freely over the field without strict control, covering the soil surface, though it often results in uneven distribution.

Checks involve dividing the field into small plots surrounded by bunds, and each plot is flooded in turn, giving better water control.

Boarder irrigation uses long parallel strips of land separated by ridges, where water is introduced at the upper end and flows down evenly.

Basin irrigation involves creating small circular or rectangular basins around individual plants or trees to hold water until it infiltrates.

Furrow irrigation uses small channels dug between crop rows, where water flows and infiltrates into the root zone of plants.

(c) Outline seven factors to be considered when operating sprinkler irrigation system

The water pressure should be adequate to ensure uniform spraying from the nozzles.

The spacing of sprinklers must be correct to ensure overlapping patterns for full coverage.

Wind speed should be minimal since strong winds can cause uneven water distribution.

The quality of water should be considered to avoid clogging nozzles with sediments or salts.

The type of crop must be suitable for overhead irrigation, as some crops are prone to leaf diseases when wetted.

The soil type should be evaluated, since sandy soils may require frequent application, while clay soils need controlled application to avoid waterlogging.

Maintenance of the system, including cleaning and checking pipes and nozzles, is necessary for efficiency.

6. (a) Define the term weathering as used in soil formation

Weathering is the natural process by which rocks are broken down physically, chemically, or biologically into smaller particles that eventually form soil.

(b) Briefly explain two types of rock weathering and show how they relate to each other

Physical weathering involves the mechanical breakdown of rocks without changing their chemical composition, such as through temperature changes, frost action, or abrasion. Chemical weathering involves the decomposition of rocks due to chemical reactions with water, air, or acids, leading to changes in mineral composition. These two processes are related because physical weathering increases the surface area of rocks, making them more susceptible to chemical reactions.

(c) Explain the four main agents of weathering work on rocks

Water is a key agent, causing both mechanical weathering through freeze-thaw action and chemical weathering through hydrolysis and dissolution.

Temperature causes expansion and contraction of rocks, leading to cracking and fragmentation.

Living organisms like plant roots and burrowing animals break rocks physically, while microorganisms can also produce acids that accelerate chemical weathering.

Wind carries abrasive particles that wear down rock surfaces gradually, contributing to their disintegration.

(d) Give one chemical equation in each case, explain any five processes involved in chemical weathering of rocks

Hydrolysis: $2KAlSi_3O_8 + 2H_2CO_3 + 9H_2O \rightarrow Al_2Si_2O_5(OH)_4 + 4H_4SiO_4 + 2K^+ + 2HCO_3^-$
This shows feldspar breaking down to form clay minerals.

Oxidation: $4Fe^{2+} + O_2 + 6H_2O \rightarrow 4Fe(OH)_3$
This process forms rust when iron minerals are exposed to oxygen and water.

Carbonation: $CaCO_3 + H_2CO_3 \rightarrow Ca(HCO_3)_2$
Limestone reacts with carbonic acid forming soluble bicarbonates.

Hydration: $2Fe_2O_3 + 3H_2O \rightarrow 2Fe_2O_3 \cdot 3H_2O$
This process adds water molecules to minerals, forming hydrates.

Solution: $NaCl + H_2O \rightarrow Na^+ + Cl^-$
Soluble minerals dissolve directly in water.

7. (a) Explain five factors affecting composition of farmyard manure

The type of livestock influences composition since different animals excrete manure with varying nutrient contents.

The type of feed determines the quality of manure because high-protein feeds lead to nutrient-rich waste.

The method of collection and storage affects nutrient loss, with exposed manure losing nitrogen through volatilization.

The age of manure also matters, as nutrients may leach or decompose over time, reducing effectiveness.

Addition of bedding materials like straw or sawdust can dilute nutrient concentration but improve organic matter.

(b) Briefly explain the following terminologies as used in fertilizer application: (i) fertilizer (ii) fertilizer analysis (iii) fertilizer grade (iv) fertilizer ratio

Fertilizer is a substance added to soil or plants to supply essential nutrients for growth.

Fertilizer analysis is the determination of nutrient content in a fertilizer, expressed as percentages of nitrogen, phosphorus, and potassium.

Fertilizer grade is the labeling of a fertilizer showing the proportion of N, P_2O_5, and K_2O it contains, usually in a set order like 20-10-10.

Fertilizer ratio is the relative proportion of N, P, and K in a fertilizer, indicating the balance between nutrients.

(c) Outline any six functions of essential plant nutrients

Nitrogen promotes leaf and stem growth by enhancing chlorophyll and protein formation.

Phosphorus supports root development and is vital for energy transfer in plants.

Potassium enhances disease resistance and improves water regulation in plants.

Calcium strengthens cell walls and aids in root and shoot development.

Magnesium is a central element in chlorophyll and essential for photosynthesis.

Sulphur is important for protein synthesis and formation of certain vitamins.

8. (a) Study the given curves of different product - product relationships and describe the relationships between (i) Y1 and Y2 (ii) Y3 and Y4 (iii) Y5 and Y6 (iv) Y7 and Y8

Y1 and Y2 show a competitive relationship where increasing one reduces the output of the other.

Y3 and Y4 have a complementary relationship where an increase in one leads to an increase in the other.

Y5 and Y6 show a supplementary relationship where one can be increased without affecting the other significantly.

Y7 and Y8 indicate a joint relationship where both outputs are produced together from the same resource.

(b) Give the meaning of the following as used in production economics (i) production function (ii) total products (iii) average product (iv) marginal product

Production function is the mathematical relationship showing how inputs are transformed into outputs.

Total products are the overall quantity of output produced by a given amount of inputs.

Average product is the output produced per unit of input used.

Marginal product is the additional output obtained by using one more unit of input.

(c) Briefly explain two characteristics of each of the three regions of the production functions

Region I is characterized by increasing returns to scale where both average and marginal products rise, showing efficient input use.

Region II has diminishing returns, where marginal product decreases but total product still increases, representing the rational zone of production.

Region III has negative returns where additional input reduces total output, making it an irrational zone of production.

9. (a) (i) Give the meaning of the term oligopoly (ii) Give four characteristics of oligopoly market condition

Oligopoly is a market structure where a few large firms dominate production and supply of goods or services.

One characteristic is interdependence, as firms must consider the actions of their competitors before making decisions.

Another is price rigidity, where firms are reluctant to change prices due to fear of losing customers.

Oligopoly also features non-price competition, such as advertising and product differentiation to attract consumers.

Barriers to entry are also common, making it difficult for new firms to compete with established players.

(b) Briefly describe the following functions of marketing: (i) standardization (ii) financing (iii) risk bearing (iv) market intelligence (v) price setting

Standardization ensures that agricultural products meet set quality and size specifications for uniformity in the market.

Financing involves providing funds to support marketing activities like storage, transportation, and promotion.

Risk bearing is the process of managing uncertainties in production, storage, and transportation that can affect sales.

Market intelligence is the collection and analysis of information about demand, prices, competitors, and consumer preferences.

Price setting is the process of determining the price of goods based on production costs, market conditions, and competition.

(c) Give the difference between black market and open market

A black market is an illegal trade where goods and services are sold without government regulation, often at higher prices due to scarcity. An open market is a legal, regulated platform where goods and services are freely exchanged with transparency in pricing.