THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL
ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

134/1   SCIENCE AND PRACTICE OF AGRICULTURE 1

(For Both School and Private Candidates)

Time: 2:30 Hours   **ANSWERS**   **Year: 2001**

Instructions

1.   This paper consists of ten (10) questions in sections A, B and C.

2.   Answer five (5) questions choosing at least one (1) question from each

     section.

3.   Each question carries twenty (20) marks.

4.   Cellura phones are not allowed in the examination room.

5.   Write your Examination Number on every page of your answer booklet(s).

AGRICULTURAL ENGINEERING AND LAND PLANNING

1. (a) Describe the working principles of a four-stroke cycle diesel engine.

A four-stroke cycle diesel engine operates through four distinct strokes of the piston inside the cylinder to complete one power cycle. These strokes are intake, compression, power, and exhaust, and they require two complete revolutions of the crankshaft.

During the intake stroke, the inlet valve opens and the piston moves downward, drawing clean air into the cylinder. Unlike petrol engines, only air is taken in at this stage, not a fuel–air mixture.

In the compression stroke, both valves close and the piston moves upward, compressing the air to a very high pressure and temperature. This high compression is essential for ignition in a diesel engine.

During the power stroke, diesel fuel is injected into the hot compressed air. The fuel ignites spontaneously due to high temperature, forcing the piston downward and producing useful mechanical energy.

In the exhaust stroke, the exhaust valve opens and the piston moves upward again, pushing out the burnt gases from the cylinder and preparing the engine for the next cycle.

1. (b) (i) Explain the function of the fuel injector.

The fuel injector sprays diesel fuel into the combustion chamber in a fine mist. This ensures proper mixing of fuel with hot compressed air, leading to efficient combustion and smooth engine operation.

1. (b) (ii) Explain the role of the glow plug.

The glow plug preheats the air inside the combustion chamber, especially during cold starting conditions. This helps the diesel fuel ignite easily when the engine temperature is low.

2. (a) A tractor pulls a three-furrow plough at a speed of 6 km per hour. The width of each furrow is 0.4 m. Calculate the theoretical field capacity in hectares per hour.

Total working width = 3 × 0.4
Total working width = 1.2 m

Theoretical field capacity = Speed × Width ÷ 10
Theoretical field capacity = 6 × 1.2 ÷ 10
Theoretical field capacity = 0.72 hectares per hour

2. (b) If the field efficiency is 75 percent, calculate the actual field capacity.

Actual field capacity = Theoretical field capacity × Field efficiency
Actual field capacity = 0.72 × 0.75
Actual field capacity = 0.54 hectares per hour

3. (a) Name four types of wood saws used in a workshop.

Four types of wood saws used in a workshop are cross-cut saw, rip saw, tenon saw, and bow saw.

3. (b) (i) Describe the use of a cross-cut saw.

A cross-cut saw is used to cut wood across the grain. It is commonly used when cutting timber into shorter lengths for construction or carpentry work.

3. (b) (ii) Explain how a hand saw is maintained to prevent rusting.

A hand saw is maintained by cleaning it after use to remove moisture and wood particles. It is then wiped with an oily cloth and stored in a dry place to prevent rust formation.

4. (a) Define the term survey station.

A survey station is a fixed point on the ground whose position is measured or marked and used as a reference point during surveying operations.

4. (b) Explain how a simple chain survey is carried out to determine the area of a small plot of land.

In chain surveying, the boundaries of the plot are first identified and marked using pegs. Straight lines are then measured using a chain or tape between survey stations.

Offsets are taken from the main survey lines to locate details such as corners. The measurements are recorded and later used to calculate the area of the plot using geometric methods.

5. (a) Discuss the factors that determine the design of a farm workshop.

The size of the farm workshop depends on the type and number of machines and tools used on the farm. Large farms require bigger workshops to accommodate machinery repairs.

The location of the workshop influences its design because it should be easily accessible and located on well-drained ground.

Availability of power and water also determines workshop design since many operations require electricity and water supply.

5. (b) (i) Explain the importance of adequate lighting in a farm workshop.

Adequate lighting improves visibility, allowing accurate and safe execution of repair and maintenance tasks. It also reduces accidents caused by poor visibility.

5. (b) (ii) Explain the importance of proper ventilation in a farm workshop.

Proper ventilation removes fumes, smoke, and dust from the workshop. This protects workers' health and prevents accumulation of harmful gases.

SECTION B
SOIL SCIENCE

6. (a) Explain how biological weathering contributes to soil formation.

Biological weathering involves the breakdown of rocks by living organisms such as plants, animals, and microorganisms. Plant roots grow into rock cracks and widen them, causing rocks to break.

Microorganisms produce organic acids that chemically decompose rocks, contributing to soil development over time.

6. (b) (i) Name two types of soil minerals.

The two types of soil minerals are primary minerals and secondary minerals.

6. (b) (ii) Describe the properties of primary soil minerals.

Primary minerals originate directly from parent rock material. They are coarse-textured, resistant to weathering, and contain nutrients that are slowly released.

7. (a) Define soil structure and explain its importance to crop growth.

Soil structure refers to the arrangement of soil particles into aggregates or peds. Good soil structure allows proper air circulation, water movement, and root penetration, which are essential for healthy crop growth.

7. (b) (i) Describe granular soil structure.

Granular soil structure consists of small, rounded aggregates commonly found in topsoil. It promotes good aeration, drainage, and root development.

7. (b) (ii) Describe blocky soil structure.

Blocky soil structure has cube-like aggregates usually found in subsoil. It allows moderate movement of air and water but can restrict roots if compacted.

8. (a) Explain the significance of soil air in the nitrogen cycle.

Soil air supplies oxygen required by nitrifying bacteria that convert ammonium into nitrates. These nitrates are essential forms of nitrogen for plant uptake.

8. (b) Describe how poor drainage affects the composition of soil gases.

Poor drainage reduces oxygen levels in the soil and increases carbon dioxide concentration. This creates anaerobic conditions that slow down beneficial microbial activity.

SECTION C
RURAL ECONOMY

9. (a) Define the law of diminishing returns as applied in agriculture.

The law of diminishing returns states that as more units of a variable input are added to fixed inputs, total output increases at a decreasing rate and eventually declines.

9. (b) (i) Describe the three stages of production using the relationship between total product and marginal product.

In stage one, total product increases at an increasing rate and marginal product rises.

In stage two, total product increases at a decreasing rate while marginal product declines but remains positive.

In stage three, total product declines and marginal product becomes negative.

9. (b) (ii) State the stage at which production is most efficient and give reasons.

Production is most efficient in stage two because resources are used optimally and marginal product is positive but declining.

9. (c) A farmer applies fertilizer to a wheat field as follows. Calculate the marginal product for each unit of fertilizer.

Marginal product at 0 units $= 20$
Marginal product at 1 unit $= 50 - 20 = 30$
Marginal product at 2 units $= 90 - 50 = 40$
Marginal product at 3 units $= 120 - 90 = 30$
Marginal product at 4 units $= 140 - 120 = 20$
Marginal product at 5 units $= 150 - 140 = 10$

9. (d) Explain why marginal product eventually declines.

Marginal product declines because fixed inputs become limiting, leading to overcrowding and inefficient use of additional inputs.

10. (a) Define agricultural marketing.

Agricultural marketing is the process of moving agricultural products from producers to consumers through activities such as storage, transportation, and selling.

10. (b) (i) List the functions of a marketing board.

Marketing boards stabilize prices, purchase produce, provide storage, and facilitate distribution.

10.(b) (ii) Distinguish between wholesalers and retailers.

Wholesalers buy goods in bulk and sell to retailers, while retailers sell goods in small quantities directly to consumers.

10.(c) A farmer sells a bag of maize at Tshs 40,000 and the consumer buys it at Tshs 75,000. Calculate the marketing margin.

Marketing margin = 75,000 − 40,000
Marketing margin = Tshs 35,000

10.(d) Discuss three problems faced by farmers when marketing perishable produce in rural areas.

Poor transport infrastructure leads to high spoilage rates.

Lack of cold storage causes rapid deterioration of produce.

Price fluctuations reduce farmers' income stability.

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