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: 2002**

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).

SECTION A

AGRICULTURAL ENGINEERING AND LAND PLANNING

1. (a) Describe the construction of a disc plough.

   A disc plough is constructed with a strong steel frame that supports all its working parts and enables it to withstand heavy soil resistance during tillage. The frame connects the plough to the tractor through a hitching system, allowing efficient power transmission.

   The main working components of a disc plough are concave circular steel discs mounted individually or in gangs. These discs are sharpened at the edges to enable them to cut through soil, trash, and crop residues effectively.

   Each disc is mounted on a bearing assembly that allows it to rotate freely as the plough moves forward. This rotation reduces friction and enables the disc to penetrate the soil smoothly.

   Scrapers are fitted close to each disc to remove soil sticking to the disc surface, ensuring continuous effective cutting and turning of the soil.

1. (b) Explain how a disc plough operates during tillage.

During operation, the rotating discs cut into the soil as the tractor pulls the plough forward. The concave shape of the discs lifts, partially turns, and breaks the soil without completely inverting it.

As the discs rotate, they slice through hard soil and crop residues, making the disc plough suitable for heavy, sticky, or trashy fields where other ploughs may fail.

The soil is loosened and mixed with plant residues, improving soil aeration and preparing the land for subsequent tillage operations.

1. (c) State two advantages of disc ploughs over mouldboard ploughs.

   Disc ploughs work efficiently in hard, dry, or sticky soils where mouldboard ploughs fail to penetrate properly.

   They are also suitable for fields with heavy crop residues because the rotating discs do not clog easily.

2. (a) Explain the importance of land levelling in irrigated agriculture.

   Land levelling ensures uniform distribution of irrigation water over the entire field.

   This prevents waterlogging in some areas and water shortage in others.

   It improves water use efficiency by reducing runoff and deep percolation losses.

   Uniform water application enhances crop growth and yield.

Land levelling also facilitates smooth farm operations such as planting, weeding, and harvesting, leading to reduced labour and operational costs.

2. (b) Describe two methods used in farm land levelling.

   Manual levelling involves the use of simple tools such as hoes, spades, and shovels to remove high spots and fill low areas. This method is suitable for small farms.

   Mechanical levelling uses tractors fitted with levelling boards or graders to achieve uniform land surfaces. It is faster and suitable for large-scale irrigation schemes.

2. (c) State two limitations of poor land levelling.

   Poor land levelling causes uneven water distribution, leading to poor crop establishment and reduced yields.

   It also increases soil erosion and water wastage due to runoff and ponding.

3. (a) Explain the working principle of a grain thresher.

   A grain thresher works by separating grains from harvested crop materials using mechanical impact and rubbing action.

   The crop is fed into the threshing drum, which rotates at high speed, striking the crop against a concave surface. This action dislodges the grains from the stalks or heads.

The separated grains fall through sieves while straw and chaff are expelled through outlets, producing clean grain output.

3. (b) State four safety precautions to observe when operating a grain thresher.

   Operators should wear protective clothing to avoid injuries from moving parts.

   Loose clothing should be avoided to prevent entanglement in rotating components.

   The machine should be switched off before cleaning or adjusting any part.

   Children and unauthorized persons should be kept away from the threshing area.

3. (c) Explain two maintenance practices for a grain thresher.

   Regular lubrication of moving parts reduces friction and wear, increasing machine lifespan.

   Cleaning the thresher after use prevents accumulation of dust and residues that may cause mechanical failure.

4. (a) Define farm mechanization.

   Farm mechanization is the use of machines and mechanical power to perform agricultural operations such as land preparation, planting, and harvesting.

4. (b) Explain four benefits of farm mechanization.

Farm mechanization increases farm productivity by enabling timely operations and covering large areas quickly.

It reduces human labour requirements, thereby lowering labour costs and drudgery.

Mechanization improves precision and efficiency in farm operations such as planting and spraying.

It enhances agricultural output, contributing to food security and economic growth.

4. (c) State two challenges of farm mechanization in developing countries.

   High initial costs of machinery limit access by small-scale farmers.

   Lack of skilled operators and maintenance services reduces effective utilization of machines.

5. (a) A tractor travels 600 m in 12 minutes.

   (i) Calculate its speed in m per minute.

   Speed = Distance ÷ Time

   Speed = 600 ÷ 12

   Speed = 50 m per minute

   (ii) Calculate its speed in km per hour.

50 m per minute = 50 × 60 = 3000 m per hour

3000 m = 3 km

Speed = 3 km per hour

5. (b) State two factors that affect tractor field efficiency.

Field shape affects efficiency since irregular fields cause frequent turning and time loss.

Soil condition influences efficiency because wet or rough soils reduce tractor speed.

SECTION B

SOIL SCIENCE

6. (a) Define soil structure.

Soil structure refers to the arrangement of soil particles into aggregates or peds of various shapes and sizes.

6. (b) Describe four types of soil structure found in cultivated soils.

Granular structure consists of small rounded aggregates that allow good aeration and drainage.

Blocky structure has cube-like aggregates common in subsoil layers.

Platy structure consists of thin horizontal plates that restrict water movement.

Prismatic structure has vertical columns often found in clay soils.

6. (c) State two effects of soil structure on root development.

   Good soil structure allows easy root penetration and expansion.

   Poor soil structure restricts root growth and reduces nutrient uptake.

7. (a) Explain the term soil moisture.

   Soil moisture refers to the water present in the soil pores that is available for plant use.

7. (b) Describe the following forms of soil moisture.

   (i) Gravitational water

   Gravitational water drains freely through soil under gravity and is not available to plants.

   (ii) Capillary water

   Capillary water is held in small soil pores and is readily available for plant absorption.

   (iii) Hygroscopic water

   Hygroscopic water is tightly held on soil particles and cannot be used by plants.

8. (a) Define soil fertility.

   Soil fertility is the ability of soil to supply essential nutrients in adequate amounts for plant growth.

8. (b) Explain four factors that influence soil fertility.

Soil organic matter increases nutrient availability and improves soil structure.

Soil pH affects nutrient solubility and uptake by plants.

Soil texture influences nutrient retention and water-holding capacity.

Biological activity enhances nutrient cycling and availability.

8. (c) State two indicators of fertile soil.

High crop yields indicate fertile soil.

Dark soil colour often reflects high organic matter content.

SECTION C

RURAL ECONOMY

9. (a) Explain the meaning of fixed costs and variable costs.

Fixed costs are expenses that do not change with the level of production, such as depreciation and land rent.

Variable costs are expenses that vary directly with production levels, such as feeds and labour.

9. (b) A dairy farmer incurs the following annual costs.

(i) Identify total variable costs.

Feeds and veterinary services are variable costs because they increase with production.

Total variable costs = 1,200,000 + 300,000

Total variable costs = Tshs 1,500,000

(ii) Identify total fixed costs.

Labour and depreciation are fixed costs.

Total fixed costs = 900,000 + 500,000

Total fixed costs = Tshs 1,400,000

(iii) Calculate total cost.

Total cost = 1,500,000 + 1,400,000

Total cost = Tshs 2,900,000

(iv) Calculate net farm income.

Net farm income = Total revenue − Total cost

Net farm income = 4,200,000 − 2,900,000

Net farm income = Tshs 1,300,000

9. (c) State two uses of net farm income.

It measures overall farm profitability.

It assists farmers in planning future investments.

10.(a) Explain the concept of agricultural credit.

Agricultural credit refers to borrowed funds provided to farmers to finance farming operations and investments.

10.(b) Describe four sources of agricultural credit.

Commercial banks provide loans to farmers for large investments.

Cooperative societies offer credit to members.

Microfinance institutions support small-scale farmers.

Government programs provide subsidized loans.

10.(c) Explain four problems associated with agricultural credit.

High interest rates increase repayment burden.

Lack of collateral limits access to loans.

Delayed loan disbursement affects farm operations.

Low financial literacy leads to poor loan management.

10.(d) State two ways of improving access to agricultural credit for smallholder farmers.

Provision of subsidized credit schemes increases access.

Strengthening farmer cooperatives enhances borrowing capacity.