NESA NATIONAL EXAMINATION AND SCHOOL INSPECTION AUTHORITY

**TVET NATIONAL EXAMINATIONS, LEVEL 5**

***MARKING GUIDE***

**EXAM NAME: SOIL CONSERVATION**

**SECTOR: AGRICULTURE AND FOOD PROCESSING**

**TRADE: FORESTRY**

**MARKS:** /100

**DURATION: 3 HOURS**

**INSTRUCTIONS TO CANDIDATES:**

**This Exam paper is composed of Three Sections (A, B, C). Follow the instructions given below, and answer the indicated questions for a total of 100 marks**

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|---|---|
| Section **A**: Fourteen (**14**) questions, all **Compulsory** | **55 marks** |
| Section **B**: Among the five (**5**) questions, attempt any three (3) | **30 marks** |
| Section **C**: Among the two (**2**) questions, attempt any one (1) | **15 marks** |



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**SECTION A: Attempt All questions** **(55marks)**

**01.** Soil degradation is a serious global environmental problem and may be increased by climate change. Name at least four (4) factors of soil degradation. **(4marks)**

**Answer:**

Four (4) factors of soil degradation are:

a. Deforestation, *(1mark)*
b. Over-exploitation of wood cover for domestic use, *(1mark)*
c. Overgrazing, *(1mark)*
d. Agricultural activities. *(1mark)*

e, settlement

**02.** The following are the activities relating to the maintenance of soil conservation structures except:

a)Desilting.

b)Pruning of fixing plants.

c)**Overgrazing, FALSE**

d)Planting cover crops. TRUE

**03.** What is the process of burning municipal solid waste? **(2marks)**

**Answer:**

The process of burning municipal solid waste is incineration. *(2marks)*

**04.** Weathering is the breaking down of huge pieces of rocks into smaller pieces of soil. List three (3) types of weathering. **(3marks)**

**Answer:**

Three (3) types of weathering are:

1. Physical type, *(1mark)*
2. Chemical type, *(1mark)*
3. Biological type. *(1mark)*

**05.**Choose the correct answer. **(2marks)**

Auger is instrument for taking soil samples from various depths and is suitable for:

a)very stiff clays, b) soft to stiff clays, c) sandy soils, d) hard clays.

**Answer:**

Auger is instrument for taking soil samples from various depths and is suitable for **(b)** soft to stiff clays *(2marks)*



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**06.** Give at least five (5) factors influencing wind erosion. **(5marks)**

**Answer:**

Five (5) factors influencing wind erosion are:

1. Wind speed,
2. Soil erodibility,
3. Soil surface roughness,
4. Climate (wind patterns, precipitation, frost action),
5. Unsheltered distance,
6. Vegetative cover,
7. Topography (exposure, elevation, terrain roughness, localised funnelling of wind),
8. Cultural practices (cultivation, vegetation depletion.

*Consider five (5) correct answers for **1mark** each one*

**07.** Soil and water conservation structures include all mechanical or structural measures that control the velocity of surface runoff and thus minimize soil erosion.. Outline five (5) maintenance of soil conservation structures. **(5marks)**

**Answer:**

Five (5) maintenance of soil conservation structures are:

1. Desilting,
2. Pruning of fixing plants,
3. Zero grazing,
4. Repairing of structure,
5. Stabilization of embankment,
6. Pyrophytes and fire breakers.

*Consider five (5) correct answers for **1mark** each one*

**08.** Igneous rocks are defined as types of rocks that are formed when molten rock (rock liquefied by intense heat and pressure) cools to a solid state. Illustrate the five (5) characteristics of igneous rock. **(5marks)**

**Answer:**

Five (5) characteristics of igneous rock are:



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1. The igneous form of rocks does not include any fossil deposits. If there are any chances of fossil deep inside the crust, it erupts out of the Earth's surface and gets destroyed due to the sheer heat these rocks produce. *(1mark)*
2. Most igneous forms include more than one mineral deposit. *(1mark)*
3. They can be either glassy or coarse. *(1mark)*
4. These usually do not react with acids. *(1mark)*
5. The mineral deposits are available in the form of patches with different sizes. *(1mark)*

**09.** In soil erosion control through mechanical/physical control methods, gabions are used for protecting the embankment from erosion and protecting the road. Explain five (5) advantages of gabions. **(5marks)**

**Answer:**

Five (5) advantages of gabions are:

1. Aesthetics: Gabion walls provide a very natural and aesthetically pleasing look as they use natural materials that incorporate with the environment. *(1mark)*
2. Durability: Most Gabion types are highly resistant to atmospheric corrosion due to the well-bonded zinc coating on the wire. *(1mark)*
3. Strength: Gabions are strong enough to resist flood forces, torrential forces, ice, and earth pressure. *(1mark)*
4. Permeability: Gabions are fully permeable. It naturally drains off the water which eliminates the need for the installation of drainage pipes. *(1mark)*
5. Flexibility: Gabion walls can be settled without failure and losing their efficiency in any situation such as unstable ground or moving water.*(1mark)*

**10.** A landslide is defined as the movement of a mass of rock, debris , or earth down a slope. Explain the human causes of landslide. **(4marks)**

**Answer:**

The human causes of landslide are;

1. Clear cutting: Method of timber harvesting which completely removes all old growth timber from the area. This method is hazardous because it destroys the existing mechanical root structure in the area. *(2marks)*
2. Mining: Mining operations that use blasting techniques often cause other areas that are at the risk of sliding to slide due to vibrations under the soil. *(2marks)*

3. Farming activities are Inappropriate
4. Inadequate Water Harvesting structures.



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**11.** KANUMA is farmer having a land of 2.5 ha.Unfortunately this land is damaged by soil erosion. For resolving that problem, he decided to plant the seedlings of Eucalyptus maiden by using the spacing of 2mx2m. As Forester worker , try to help him to know the number of seedling required for planting that land. **( 5marks)**

**Answer:**

Given: Area=2.5ha=250000m² *(1mark)*

Spacing=2.5mx2.5m

Area for one seedling=2.5mx2.5m=6.25m² *(1mark)*

Number of seedlings= $\frac{\text{Total area number of seedlings}}{\text{Area of one seedling}}$ *(1mark)*

Number of seedlings=$\frac{25000m2}{6.25m2}$x1seedling =4000 seedlings*(2marks)*

**12.** Considering the following tools and equipment used in erosion control in forest: Dumpy level, Suunto ,Clinometer, N- frame level,Theodolite, A- frame level. Identify:

a) Two (2) optical tools and equipment. **(2marks)**

b) Three (3) mechanical tools and equipment. **(3marks)**

**Answer:**

a) Two (2) optical tools and equipment are:

- ✓ Dumpy level. (*1mark*
- ✓ Theodolite. (*1mark)*

b) Three (3) mechanical tools and equipment

- ✓ N- frame level, (*1mark)*
- ✓ A-frame level, (*1mark)*
- ✓ Tape measure. (*1mark)*

**13.** Considering the following erosion control methods: terraces, cover crops, using stones, reforestation , ditches .Organize them into: Agronomic control techniques and Mechanical control techniques. **(5marks)**

**Answer:**

a)Agronomic control techniques are: Cover crops and reforestation. *(2marks)*

b)Mechanical control techniques are: Terraces, using stones and ditches. *(3marks)*

**14.** The farmer has the ditches containing silt coused by water erosion and around them there many weeds which stop the movement of running water.Develop the required maintenance practices for those ditches.

**(3marks)**

**Answer:**

The required maintenance practices for those ditches are:



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1. Desilting: is the removal of fine silt and sediment that has collected in ditches. *(1mark)*
2. Weeding: is the process to remove out the weeds. Weeding is required for anti-erosive ditches to increase water flow and prevent flooding and erosion. *(1mark)*
3. Clearing: clearing of anti-erosive ditches and other erosion control infrastructure improves the water flow movement. *(1mark)*

4. Reshaping: is to give back it's recommended shape

**SECTION B: Attempt any Three (3) questions** **(30 marks)**

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**15**. Wastes are unwanted or unusable material and could be hazardous. Classify and explain different types of wastes. **(10marks)**

**Answer:**

Different types of wastes are:

1. Liquid type:(*1mark*. Waste can come in non-solid form. Some solid waste can also be converted to a liquid waste form for disposal. It includes point source and non-point source discharges such as storm water and waste water. (*1mark)*
2. Solid type: *1mark*. Solid waste predominantly, is any garbage, refuse or rubbish that we make in our homes and other places. This garbage is generated mainly from residential and commercial complexes. (*1mark)*
3. Hazardous type:(*1mark)*. Hazardous or harmful wastes are those that potentially threaten public health or the environment. Such waste could be inflammable (can easily catch fire), reactive (can easily explode), corrosive (can easily eat through metal) or toxic (poisonous to human and animals. (*1mark*)
4. Organic type: (*1mark)*. Organic waste comes from plants or animals sources. Commonly, they include food waste, fruit and vegetable peels, flower trimmings can be classified as organic waste. They are biodegradable (this means they are easily broken down by other organisms over time and turned into manure). (*1mark)*
5. Recyclable type:(*1mark*). Recycling is processing used materials (waste) into new, useful products. This is done to reduce the use of raw materials that would have been used. (*1mark)*

**16.**Water erosion is the transport of soil and eroded materials by water away from the point of removal and reduce ability of the soil to store water and nutrients. Distinguish different types of water erosion. **(10marks)**

**Answer:**

Different types of water erosion are:

1. Rain Drop or Splash Erosion: (*1mark).*The erosion due to the impact of falling raindrops on the soil surface leading to the destruction of the crumb structure is known as raindrop or splash erosion. *(1mark)*
2. Sheet Erosion: (*1mark)*. It is the uniform removal of soil in thin layers from the land surface caused by the wind. *(1mark)*



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3. Rill Erosion: (*1mark*).Rill erosion is a form of water erosion in which the erosion takes place through numerous narrow and more or not so straight channels called streamlets or head cuts. (*1mark*)
4. Gully erosion: (*1mark*).Gully erosion occurs due to the runoff of surface water, causing the removal of soil with drainage lines. *(1mark)*
5. Stream bank erosion: (*1mark*).Bank erosion is nothing but washing up away from banks of a stream or a river. (*1mark*).

**17.** Soil physical properties are those related to the size and arrangement of solid particles, and how the movement of liquids and gases through soils is affected by the particles. Discuss on the physical properties of the soil .

**(10marks)**

**Answer:**

Physical properties of soil include color, texture, structure, porosity, density, consistence, aggregate stability, and temperature.

1. Soil texture (such as loam, sandy loam or clay): (*1mark*).refers to the proportion of sand, silt and clay sized particles that make up the mineral fraction of the soil. (*1mark*).
2. Soil structure: (*1mark*).describes the arrangement and organization of soil particles in the soil, and the tendency of individual soil particles to bind together in aggregates.(*1mark*).
3. Soil density: (*1mark*).is related to the mineral and organic composition of a soil and to soil structure. (*1mark*).
4. Porosity: (*1mark*).Pore space is that part of the bulk volume of soil that is not occupied by either mineral or organic matter but is open space occupied by either gases or water. (*1mark*).
5. Soil consistence: (*1mark*).refers to the ease with which an individual ped can be crushed by the fingers. (*1mark*).
6. Soil temperature: (*1mark*).is affected by climate, water content of a soil, soil color, soil cover (e.g. presence or absence of mulch), depth in the soil profile, and air and water flow within a soil. (*1mark*).
7. Water Holding Capacity: is capacity of soil to keep / Hold water

*Consider five (5) correct answers for* ***2marks*** *each one*

**18.** Invasive species is a plant or animal that is not native to a specific location (an introduced species), and has a tendency to spread, which is believed to cause damage to the environment, human economy and/or human health. Explain the measures taken to control invasive species.

**(10marks)**



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**Answer:**

Measures against invasive plants are:

1. Pulling: remove the plant from the soil; requires only a pair of work gloves; pulling tools may be used for large plants, shrubs, or trees.
2. Hoeing: scrape seedlings from the soil or cut off small plants just below the soil level; a variety of hand-held tools may be used.
3. Tilling: break, cut, or uproot plants from the soil and alter soil environment; use equipment such as plows, Page 35 of 39 blade plows, harrows, and cultivators.
4. Mowing: cut or shred aboveground vegetation; mechanical mowers may be used, or hand-held sickles, scythes, or machetes.
5. Cutting: lop off plants at ground level; saws, axes, and loppers are used
6. Stabbing: damage the underground carbohydrate storage structure (e.g., taproot, root corm, or rhizome); spade, pruning saw, or knife is pushed into the storage structure.
7. Girdling: cut away a strip of bark several inches wide around trunks of trees or woody vines to interrupt the flow of nutrients to leaves and active growing points (meristematic tissue); cuts are made with a knife, axe, or saw.
8. Chaining: drag a heavy chain between two tractors to crush or uproot shrubs or trees.
9. Mulching: physically impede plant growth and exclude light from germinating plants; mulches may be organic such as straw, sawdust, or crop residues, or synthetic such as woven plastic or nylon.
10. Soil Solarization : cover damp soil to trap heat and increase soil temperatures to levels that are lethal to plants and seeds; use clear or black plastic.

*Consider five (5) correct answers for* ***2marks*** *each one*

**19.** Erosion control measures are intended to prevent or reduce movement of eroded soil sediment of land. Explain the measures can be taken to prevent soil erosion and ensure soil conservation. **(10marks)**

**Answer:**

The following measures can be taken to prevent soil erosion and ensure soil conservation:

1. Terrace Farming: *(1mark).* On hilly slopes, terraces act as bunds and prevent the soil from being washed away by running water. *(1mark)*
2. Shelter Belts:*(1mark).* Peasants plant trees in several rows to reduce wind erosion. They are called 'wind breaks'. *(1mark)*
3. Contour Ploughing:*(1mark).* Ploughing along contours on a slope prevents soil being washed away by rains or by surface run off. Contours act like bunds. Terraces are leveled into step-like small fields with even slopes. *(1mark)*



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4. Strip Cropping: *(1mark)* In this system, crops are grown in alternate strips of land in order to check the effect of the winds. *(1mark)*
5. Construction of dams: *(1mark)* Rivers are known to cause soil erosion. Dams are built in the upper course of the rivers in order to control the erosion of soil. *(1mark)*

**SECTION C: Attempt only one (1) question** **(15 marks)**

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**20.** Soil conservation measures should aim at preventing or at least minimizing the soils loss. Discuss on the biological methods used in soil conservation.
**(15marks)**

**Answer:**

1. Strip cropping: *(1mark)* Spreading vegetation or crops are established in a strip which is at right angles to the flow of water*(1mark)* or prevailing wind. *(1mark)*
2. Mulching and green manure: *(1mark)* Mulch may be defined as protective covering over the soil surface that is intended to minimize evaporation losses.*(1mark)* Green manures may be applied as mulches. Leaves, straw, hay, sawdust are the materials most commonly used. Paper and plastic may also be used. *(1mark)*
3. Cover crops: *(1mark)* Cover crops are fast growing plants which grow close to the ground*(1mark)*. Cover crops have many leaves and are mainly crops from the legume family. *(1mark)*
4. Afforestation: *(1mark)* Forest provides a dense cover to the soil surface. *(1mark)* The trees provide a dense canopy which reduces the velocity of raindrops. The shed leaves provide a thick mulch which reduces surface run-off and allow water infiltration. The tree roots bind the soil particles together reducing erosion. *(1mark)*
5. Grassed waterways: *(1mark)* Drainage channels which lead away excess water and are covered by grass are known as grassed waterway*(1mark)*. The common grasses used are star grass and pasparum. The grasses prevent running from washing away the soil on the flow of the waterway and embankment. *(1mark)*
6. Grass strip: *(1mark)* is a narrow band of grass planted along the contour. *(1mark)* On a steep slope soil erosion can be effectively controlled by using grass strips. *(1mark)*
7. Crop rotation: *(1mark)* Extended crop rotation and permanent cover crops effectively protect the soil from the impact of raindrops.*(1mark)* The thick, fibrous root systems associated with cover crops also bind the soil particles together. *(1mark)*

*Consider five (5) correct answers for* ***3marks*** *each one*

**21.** Soil erosion is a natural process that removes soil from one location to another. It becomes a problem when human activity causes it to occur much faster than under



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natural conditions. Discuss on the negative effects of water erosion in Rwanda. **(15marks)**

**Answer:**

Negative effects of water erosion in Rwanda are:

1. Soil loss: *(1mark)* The effects of soil erosion go beyond the loss of fertile land loss of soil structure, nutrient degradation, and soil salinity. *(1mark)* It results in the progressive down-slope movement of soil, causing severe soil loss on upper slope positions and accumulation in lower-slope positions. *(1mark)*
2. Water sedimentation: *(1mark)* Sedimentation occurs when eroded material that is being transported by water, settles out of the water column onto the surface, as the water flow slows*(1mark).*The sediments that form a waterway's bed, banks and floodplain have been transported from higher in the catchment and deposited there by the flow of water. *(1mark)*
3. Fertility decrease: *(1mark)* Soil fertility decline occurs when the quantities of nutrients removed from the soil in harvested products exceed the quantities of nutrients being applied.*(2marks)*
4. Loss of fauna and flora by erosion: *(1mark)* Biodiversity loss is the extinction of species (plant or animal) *(1mark)* worldwide, and also the local reduction or loss of species in a certain habitat. *(1mark)*
5. Low production and productivity: *(1mark)* Erosion can decrease rooting depth, soil fertility, organic matter in the soil and plant-available water reserves *(1mark)* .Accelerated erosion affects productivity both directly and indirectly. *(1mark)*
6. Economic effect: *(1mark)* Soil erosion is not only an environmental issue; it also causes huge losses to the economy. *(1mark)*Therefore, different economic activities can be destroyed by erosion. Some of them are land degradation, forest cover loss, infrastructure loss, water pollution. *(1mark)*

*Consider five (5) correct answers for* ***3marks*** *each one*

**END OF ASSESSMENT!**



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