MACHAKOS UNIVERSITY

University Examinations for 2022/2023 Academic Year

SCHOOL OF AGRICULTURE, ENVIRONMENT AND HEALTH SCIENCES

DEPARTMENT OF AGRICULTURAL SCIENCES

THIRD YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (AGRICULTURAL EDUCATON AND EXTENSION)

BACHELOR OF ENVIRONMENTAL STUDIES)

AGN 252: SOIL AND WATER CONSERVATION

DATE: **TIME:**

INSTRUCTIONS: Answer **Question ONE (Compulsory)** and Any other **Two** Questions.

a) Explain four roles of soil structure in water storage and water availability as explained in soil and water conservation practises. (4 marks)

b) Explain the following as it is used in soil and water conservation:

i. Sustainable land use (2 marks)

ii. Sensitivity (2 marks)

iii. Resilience (2 marks)

c) With an aid of a sketch explain how the following forms will impact flow in a river after a heavy downpour in Machakos town.

i. Interflow (2 marks)

ii. Base flow (2 marks)

d) Explain the four sources of Errors in rain gauges (4 marks)

e) Describe any four soil and water conservation measures that can be undertaken to reduce or eliminate the risks of landslides. (4 marks)

f) Explain four importance of water harvesting from a roof catchment to be used in one-acre farm. (4 marks)

g) Distinguish between the following types of surface irrigation:

i. Border Dike Irrigation and Basin Irrigation (2 marks)

ii. Graded Furrow Irrigation and Corrugated Irrigation (2 marks)

QUESTION TWO (20 MARKS)

a) Discuss six factors affecting runoff in an agricultural land. (6 marks)

b) Discuss four areas in which drainage can be practised. (6 marks)

c) Determine the weight of water (in kN) that must be added to a cubic meter of soil to attain a 95% degree of saturation, if the dry weight is 17.5kN/m^3, its moisture is 4%, the specific gravity of soils is 2.65 and the soil is entirely made up of a clean quartz sand. (8 marks)

QUESTION THREE (20 MARKS)

a) Discuss three factors that influences the likelihood of the occurrence of degradation. (6 marks)

b) You are a soil and water conservation expert and you are to educate farmers in Machakos on macro-catchment structures. Discuss the three macro-catchment water-harvesting structures to be constructed in the area. (6 marks)

c) Discuss the surveying process to be followed when assessing the extent of degraded agricultural land. (8 marks)

QUESTION FOUR (20 MARKS)

a) Discuss three requirements for the selection and design of physical soil and water conservation structures. (6 marks)

b) Discuss the type of errors experienced in the use of mapping and levelling instruments in determining the soil and water conservation site. (6 marks)

c) Rational Method is used in estimation of runoff water in an agricultural field for the design of culvert or any discharge structure. A 210-acre land collects water and discharges to a rangeland. With rainfall intensity of 8cm/hr and corresponding land use and runoff coefficient as given below.

Land Use	Area (Acre)	Runoff Coefficient
Roads	20	0.70
Lawn	42	0.10
Residential Area	124	0.30
Industrial Area	24	0.80

Calculate:

i. Equivalent runoff coefficient (4 marks)

ii. Runoff discharge (Q) (4 marks)

QUESTION FIVE (20 MARKS)

a) A maize crop growing in unrestricted clay loam soil profile was measured to have an active root zone depth of 1.4m. The mean crop evapotranspiration for the maize during the peak period was 6mm/day. If the field capacity and permanent wilting point for the clay loam is 34% and 14% respectively by volume (θ_{fc} = 34%, PWP = 14%) and bulk density of the soil, $\rho b = 1.5 g/cm^3$, determine the maximum irrigation interval (in days) if the allowable depletion, 'p' = 0.5. (8 marks)

b) Explain three methods of surveying that can be use in an agricultural land. (6 marks)

c) With a sketch of greenhouse, show the components of a roof catchment to be used in irrigation system. (6 marks)