



MACHAKOS UNIVERSITY

University Examinations for 2021/2022 Academic Year

SCHOOL OF AGRICULTURAL SCIENCES

DEPARTMENT OF AGRICULTURAL EDUCATION AND EXTENSION

THIRD YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE IN AGRICULTURAL EDUCATION AND EXTENSION

FOURTH YEAR BACHELOR OF SCIENCE (ENVIRONMENTAL SCIENCE)

BACHELOR OF SCIENCE (ENVIRONMENTAL RESOURCE CONSERVATION)

AGN 352: SOIL AND WATER CONSERVATION

DATE:

TIME:

INSTRUCTION TO CANDIDATES:

1. Attempt Question ONE and any other TWO questions.
2. Use neat sketches where appropriate

SECTION A: (COMPULSORY)

QUESTION ONE (30 MARKS)

- a) Define the term soil erosion. (1 mark)
- b) Explain four importance of soil and water management and conservation programmes. (4 marks)
- c) Explain four applications of the Universal Soil Loss Equation (USLE). (4 marks)
- d) Students from the School of Agriculture and Environmental Sciences at Machakos University has an experimental field in their university farm whose rainfall runoff factor is 100. The field consists of sandy loam with an average organic matter content whose erodibility factor is 0.40. The field's slope length is 244m long with a 6% slope and its length-slope factor is 1.91. The test crop is mangoes whose factor is 0.4 and they are using spring plow tillage method. The students use a cross-slope farming method with a factor of 0.75. From the above information, and by the use of the tables provided, answer the following questions.

- i) Calculate the long-term average annual rate of erosion. (4 marks)
- ii) Which tillage method will be best suited for this field in order to reduce the soil losses below tolerable levels. Show how you arrive at your conclusion. (3 marks)

Table 1 (tillage method factor)

Tillage Method	Factor
Fall plow	1.0
Spring plow	0.90
Mulch tillage	0.60
Ridge tillage	0.35
Zone tillage	0.25
No-till	0.25

Table 2 (Soil Loss Tolerance Rates)

Soil Erosion Class	Potential Soil Loss/tonnes/hectare/year (tons/acre/year)
Very low (tolerable)	<6.7 (3)
Low	6.7 (3)-11.2 (5)
Moderate	11.2 (5)-22.4 (10)
High	22.4 (10)-33.6 (15)
Severe	>33.6 (15)

- e) As a soil and water conservation expert, you have been given a task to develop a contour map of Mua Hills in Machakos County so as to assist in construction of soil and water conservation structures in the catchment, outline the main characteristics of contours that you would put in consideration while preparing, reading and interpreting your contour maps. (6 marks)
- f) Define the term runoff and explain the various processes of runoff generation in a watershed (4 marks)
- g) Define the term surveying. (2 marks)
- h) Differentiate between plane and geodetic survey. (2 marks)

SECTION B: ANSWER ANY TWO QUESTIONS (40 MARKS)

QUESTION TWO (20 MARKS)

- a) Explain three causes of land degradation. (6 marks)
- b) Explain the importance of the main parameters that are used in the USLE when preparing watershed management plans. (6 marks)
- c) Describe three distinct stages of soil erosion: (3 marks)
- d) Discuss five factors that affects soil erosion in a watershed. (5 marks)

QUESTION THREE (20 MARKS)

- a) Explain how the following factors influence how much soil can be eroded
- a) Drop size distribution (2 marks)
 - b) Direction of slope (2 marks)
- b) Explain five principles of soil conservation (5 marks)
- c) With an aid of a well labeled diagrams, describe the four stages of gully development in catchments. (4 marks)
- d) The Mbooni and Kiima Kimwe hills watersheds in Makueni County received an average rainfall intensity of 50mm/hr and 85mm/hr during the month of May 2021 respectively. Calculate the average kinetic energy of raindrops for each hill. (3 marks)
- e) Citing relevant examples in each case, discuss the four main sustainable land management practices that are mostly used for soil and water conservation in Kenya's farming systems. (4 marks)

QUESTION FOUR (20 MARKS)

- a) Briefly discuss the importance of vegetation in soil and water conservation (4 marks)
- b) Explain the three major principles on conservation agriculture that are practiced in Kenya. (3 marks)
- c) Briefly explain how soil erosion rate can be determined in the field using erosion pins. (5 marks)
- d) Discuss the main types of water erosion. (8 marks)

QUESTION FIVE (20 MARKS)

- a) Describe in-situ rain water harvesting. (2 marks)
- b) Discuss how in-situ rainwater harvesting can be achieved in crop fields. (6 marks)
- c) In the management of soil erosion, explain why one needs to approach it from both crop management and soil management. (3 marks)
- d) Differentiate between the following soil management practices in terms of applicability
- i) Stubble mulch tillage and deep tillage (3 marks)
 - ii) Farmyard manure and green manure (3 marks)
 - iii) Nurse cropping and multi-storey cropping (3 marks)

