



MACHAKOS UNIVERSITY

University Examinations for 2016/2017

SCHOOL OF AGRICULTURE AND NATURAL RESOURCES MANAGEMENT

DEPARTMENT OF OF AGRICULTURAL EDUCATION AND EXTENSION

**FIRST SEMESTER EXAMINATION FOR THE DIPLOMA IN AGRICULTURAL
EDUCATION AND EXTENSION**

KRM 0302: SOIL AND WATER MANAGEMENT

Date: 30/11/2016

Time: 2:00 – 4:00 PM

SECTION A: ANSWER ALL QUESTIONS (30 MARKS)

QUESTION ONE (COMPULSORY) (30 MARKS)

- (a) Differentiate between the following terms:
- i) Geodetic and plane surveying (2 marks)
 - ii) Differential and profile levelling (2 marks)
 - iii) Rainfall erosivity and soil erodibility (2 marks)
 - iv) Check basin and furrow surface irrigation systems (2 marks)
 - v) Height of instrument and level surface (2 marks)
 - vi) Geodetic and plane surveying (2 marks)
- (b) A long narrow farm measures 1250m along a slope of 8% and 80m along the contour. The soils are deep moderately pervious clay loam. The farmer has reserved 5ha for grazing, 2ha for woodlot and the rest for cultivation. Using Tables 1, 2 and Figure 1 estimate by rational formula the runoff overflowing from this farm to the next farm down slope. (10 marks)

- (c) Figures in the table below were extracted from a level field book. Insert the missing figures and carry out arithmetic check of your results (8 marks)

BS	IS	FS	HI	RL	REMARKS
?			279.08	277.65	OBM
	2.01			?	
	?			278.07	
3.37		0.40	?	278.68	
	2.98			?	
	1.41			280.64	
		?		281.37	TBM

SECTION B: ANSWER ANY TWO (2) QUESTIONS (40 MARKS)

QUESTION TWO (20 MARKS)

- (a) A farm near Machakos town measures 225m along a slope of 10% and 110m along the contour. This region has rainfall with high intensity, thus take rainfall factor and soil erodibility factor to be 4 and 2 respectively. If an officer wants to lay out terrace lines on this farm, determine;
- Vertical Interval (VI) (4 marks)
 - Horizontal Interval (HI) (2 marks)
 - Number of terrace lines (2 marks)
 - Discharge by each terrace into the waterway, take rainfall intensity and runoff coefficient as 120mm/hr and 0.45 respectively. (4 marks)
- (b) Outline steps of constructing soil and water conservation structures (8 marks)

QUESTION THREE (20 MARKS)

- (a) List advantages and disadvantages of plane table surveying. (10 marks)
- (b) The soil loss from a contoured Machakos University farm planted with maize was established to be 650Mg/ha/year using the universal soil loss equation. If the field was 350m along a uniform slope of 10%, determine the soil loss after terracing. Use the table below and assume that the crop management remains the same. (10 marks)

% slope	Contour farming	Contour farming + strip cropping + Rotation cropping	Contour farming + Terracing
2 - 8	0.45	0.25	0.11
9 - 13	0.60	0.35	0.13
14 - 19	0.85	0.45	0.18

QUESTION FOUR (20 MARKS)

- (a) Discuss components of the Universal Soil Loss Equation (USLE) (10 marks)
- (b) A slope distance of 5000m was measured using a 30m tape. If the percentage slope of the land was 24%, calculate the correct horizontal distance of the measured line. Assume that the tape was checked before and after fieldwork and found to be of standard length. (10 marks)

QUESTION FIVE (20 MARKS)

- (a) In laying out a graded terrace whose outlet was at waterway using a dumpy level, a staff reading at the waterway was found to be 2.73m. If an extension officer wanted to lay out terrace with average gradient of 0.8% with pegs separated 10m apart and the total length of the terrace is 145m. What will be the expected staff readings of the 15 stations if the instrument remained unchanged? (15 marks)
- (b) List five (5) advantages of cultural measures in soil and water conservation management (5 marks)

Table 1. Runoff coefficient values for use with the Rational formula

Topography and Vegetation	Soil Texture		
	Open Sandy Loam	Clay and Silt Loam	Tight Clay
Woodland			
Flat 0-5 per cent slope	0.10	0.30	0.40
Rolling 5-10 per cent slope	0.25	0.35	0.50
Hilly 10-30 per cent slope	0.30	0.50	0.60
Pasture			
Flat	0.10	0.30	0.40
Rolling	0.16	0.36	0.55
Hilly	0.22	0.42	0.60
Cultivated			
Flat	0.30	0.50	0.60
Rolling	0.40	0.60	0.70
Hilly	0.52	0.72	0.82
Urban Areas			
	30% of area impervious	50% of area impervious	70% of area impervious
Flat	0.40	0.55	0.65
Rolling	0.50	0.65	0.80

Table 2. Time of concentration for small catchments

Area (ha)	Time of concentration (minutes)
0.4	1.4
2.0	3.5
4.0	4.0
40	17
200	41
400	75

Rainfall intensity (mm/h) Source: Republic of Kenya, 1978. Rainfall Frequency Atlas of Kenya, Ministry of Water Development, p.107.

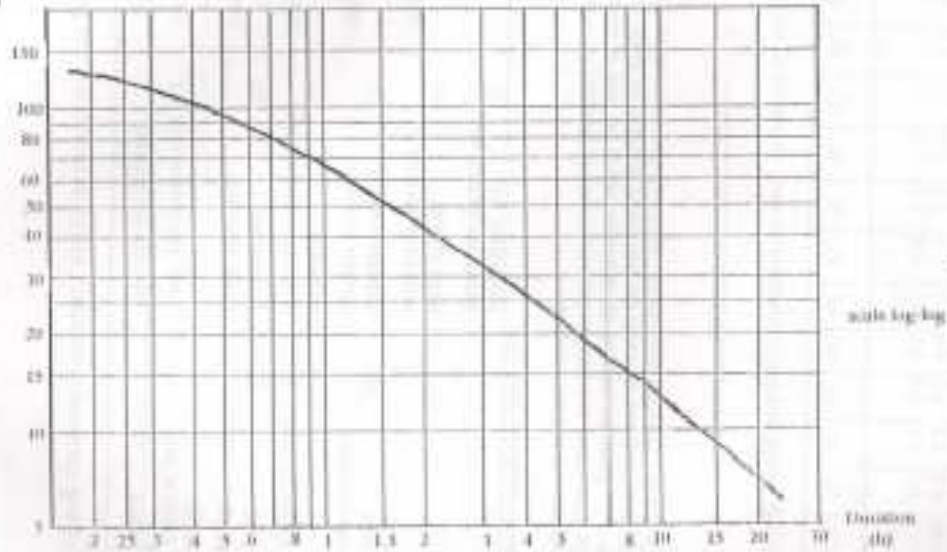


Figure 1. Typical rainfall intensity-duration curve for 10 year frequency (Mbitanga reservoir)