UNIVERSITY OF SWAZILAND
SUPPLEMENTARY EXAMINATION PAPER

PROGRAMME: DIPLOMA IN AGRICULTURE 3
DIPLOMA IN AGRICULTURAL EDUCATION 3

COURSE CODE: LUM 302

TITLE OF PAPER: SOIL AND WATER CONSERVATION

TIME ALLOWED: TWO (2) HOURS

SPECIAL MATERIAL REQUIRED: NONE

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY TWO OTHER QUESTIONS.

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SECTION A: COMPULSORY QUESTION

QUESTION 1

a) Determine the time of concentration (Tc) for a catchment area with maximum length of 3 km and a difference in height (elevation) of 40m, from the upper most point to the lowest point of the catchment.

$$Tc = 0.0195L^{0.77}S^{-0.385}$$ **[5 marks]**

b) Estimate the expected runoff for a storm which lasts for the duration of the time of concentration in (a) above if the catchment area was 500ha and had the following land uses and characteristics:

250 ha is under mature woodland, in shallow soils (Group D)
100 ha is under permanent pasture, in shallow soils (Group D)
150 ha is with row crops under good management in deep, well drained soils (Group A)

[15 marks]

c) Describe in detail the factors that affect erodibility of the soil, and illustrate how each factor can be manipulated to reduce erosion. **[10 marks]**

d) Determine the appropriate/recommended spacing between check dams made of stones to control gully erosion if the slope is 7^0, and the check dams are to be of 90cm height. **[10 marks]**

SECTION B: CHOOSE ANY TWO QUESTIONS

QUESTION 2

a) What are the three (3) types of strips utilized in strip cropping? **[3 marks]**

b) An area in the Lowveld of Swaziland was cleared for the purpose of growing crops. The environmental impact assessment was done in accordance with the Swaziland Environmental Authority's (SEA) requirements. The fields were eventually established and the site plan showed the width of strip for the fields as 42.8m. Compute the slope of the cleared site, given the following equation.

$W = 51.2 - 2.1S$ **[5 marks]**

c) Name the three (3) types of terraces. **[3 marks]**

d) Name the two (2) types of mechanical or engineering methods of soil conservation other than terraces. **[4 marks]**

e) Discuss the problems associated with terrace channels when used for soil conservation on arable land. **[15 marks]**

QUESTION 3

a) State the importance of water harvesting in modern Southern Africa. **[2 marks]**

b) A farmer wanted to harvest water that collected over a 30.0 ha catchment area having sandy loam soil, which was relatively flat, and fair with a runoff coefficient of 0.5, while 20.0 ha of the catchment area was clay, hilly and good with a runoff coefficient of 0.65. Given that the rainfall intensity was estimated to be 133 mm/h, calculate the peak run-off rate using the rational formula (see equation 4.1).

$$Q = 0.0028\ CIA$$ **[10 marks]**

c) Briefly describe the effect of the following in the rate of water erosion.

i) Rain drop impact **[6 marks]**

ii) Infiltration rate **[6 marks]**

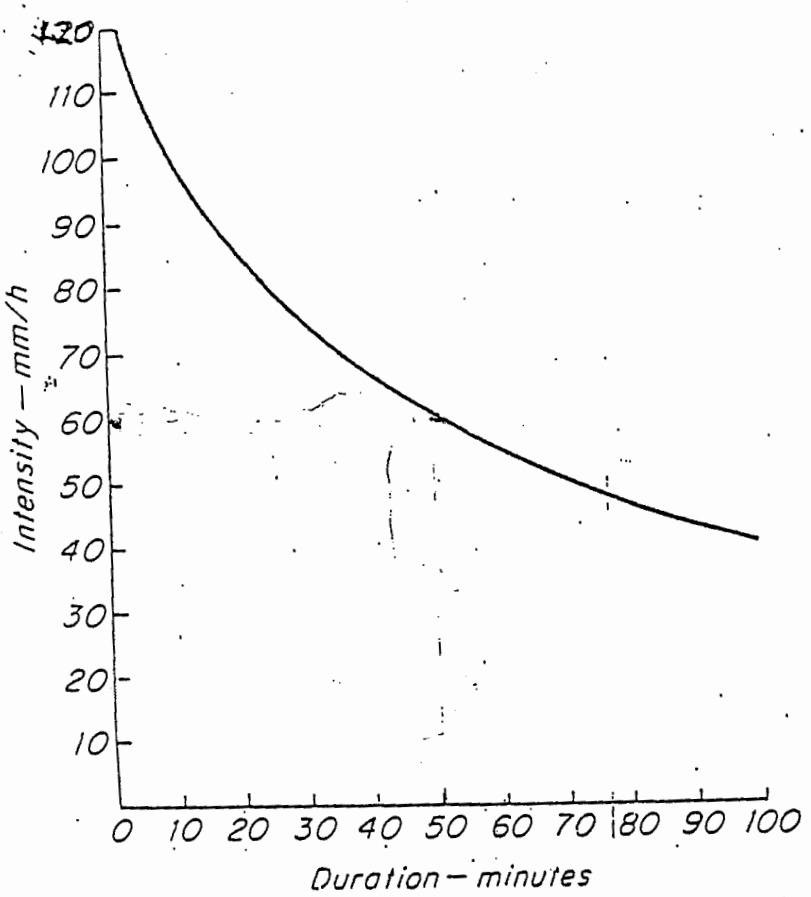
iii) Contour strips **[6 marks]**

QUESTION 4

A. Maximizing infiltration and minimizing run-off are important objectives in soil and water conservation. Describe the factors a farmer has to consider in pursuing the objectives above. **[15 marks]**

B. Determine the time of concentration (Tc) for a catchment area with maximum length of 2.4 km and difference in height (elevation) of 30 m from the upper point to the lower point of the catchment.

$$Tc = 0.0195L^{0.77}S^{-0.385}$$ **[15 marks]**



Runoff Coefficient "C" for Agricultural Watersheds (Soil Group B)

Cover and hydrologic Condition	*Coefficient C for rainfall rates of*		
	25 mm/h (1 iph)	*100 mm/h (4 iph)*	*200 mm/h (8 iph)*
Row crop, poor practice	0.63	0.65	0.66
Row crop, good practice	0.47	0.56	0.62
Small grain, poor practice	0.38	0.38	0.38
Small grain, good practice	0.18	0.21	0.22
Meadow, rotation, good	0.29	0.36	0.39
Pasture, permanent, good	0.02	0.17	0.23
Woodland, mature, good	0.02	0.10	0.15

Source: Horn and Schwab (1963).

Table .2 Hydrologic Soil Group Conversion Factors

Cover and hydrologic condition	*Factors for converting the runoff coefficient C from group B soils to"*		
	Group A	*Group C*	*Group D*
Row crop, poor practice	0.89	1.09	1.12
Row crop, Good practice	0.86	1.09	1.14
Small grain, poor practice	0.86	1.11	1.16
Small grain, good practice	0.84	1.11	1.16
Meadow, rotation, good	0.81	1.13	1.18
Pasture, permanent, good	0.64	1.21	1.31
Woodland, mature, good	0.45	1.27	1.40