UNIVERSITY OF ESWATINI
SPECIAL PAPER

PROGRAMME: BSc AGRICULTURAL EDUCATION AND AGRICULTURAL EXTENSTION III

COURSE CODE: ABE301

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 One

a. A soil is sampled using a cylinder with a diameter of 7.8cm and a length 8 cm. Calculate the volumetric water content, and wet and dry bulk densities using the following information: **10 marks**

   i. Weight of empty cylinder =300g

   ii. Weight cylinder with wet soil = 1000g

   iii. Weight of cylinder with oven dries soil = 860g

b. Determine the porosity (%) of a soil sample whose particle density is 2.65 g/cm3 and a bulk density of 1.8 g/cm3. **5 marks**

c. What soil texture is this soil sample likely to be and give at least two reasons for your choice? **5 marks**

d. Describe any two of the factors taken into consideration when designing a grassed waterway. **10 marks**

(30 marks)

SECTION B. ANSWER ANY TWO QUESTIONS

Question Two

a. Using examples, explain the difference between agronomic and mechanical soil conservation practices? **15 marks**

b. Explain the meaning of the following terms using equations to illustrate;

   i. Soil porosity /3

   ii. Degree of soil saturation /4

   iii. Void ratio /3

10 marks

(25 marks)

Question Three

a. Design a parabolic waterway (based on MANNING's formula for velocity) to convey the peak runoff of $0.5m^3/s$ if the slope of the area is 2.1%, permissible velocity 1.5m/s and the roughness coefficient is 0.035. Allow a 20 % freeboard.

$$V = \frac{R^{2/3} S^{1/2}}{n}$$

20 marks

b. Describe the importance of mulching and minimum tillage in soil and water conservation **5 marks**

(25 marks)

Question Four

a. Calculate slopes across each of the mentioned areas allocated to the various land uses.

Land Use type	Contours (m)	Horizontal Interval (km)
Woodland, mature, good	1518 - 1240	5
Pasture, permanent practice	1260 - 903	4
Residential area	1185 - 1070	4
Row crop, good practice	1190 - 1081	5
Woodland, mature, good	1070 - 561	8

10 marks

b. Explain the relevance of the following factors considered when estimating the amount of soil loss in an area using the USLE;

i. Soil management

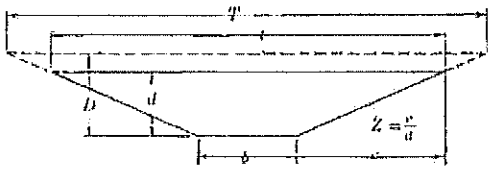
ii. Rainfall erosivity

iii. Soil erodibility

15 marks

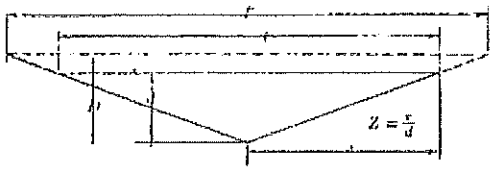
(25 marks)

Note: Freeboard = $D-d$ for all sections



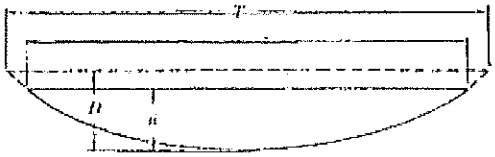
Cross-Sectional Area a	Wetted Perimeter, p	Hydraulic Radius $R=\frac{a}{p}$	Top Width
$bd + Zd^2$	$b + 2d\sqrt{Z^2+1}$	$\frac{bd + Zd^2}{b + 2d\sqrt{Z^2+1}}$	$t = b + 2dZ$ $T = b + 2DZ$

Trapezoidal cross section



Zd^2	$2d\sqrt{Z^2+1}$	$\frac{2d}{2\sqrt{Z^2+1}}$ or $\frac{d}{2}$ approx.	$t = 2dZ$ $T = \frac{D}{d}t$

Triangular cross section



$\frac{2}{3}td$	$t + \frac{8d^2}{3t}$	$\frac{t^2 d}{t^3 + 4d^2}$ or $\frac{2d}{3}$ approx.	$t = \frac{a}{0.67d}$ $T = t\left(\frac{D}{d}\right)^{\frac{1}{2}}$

Parabolic cross section

(After Schwab et al)