UNIVERSITY OF ESWATINI
FINAL EXAMINATION 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:

   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 four of the factors taken into consideration when designing a grassed waterway.

20 marks

[40 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. It is alleged that the combination of agronomic and mechanical soil conservation practices are more effective in prevention of soil erosion and its rehabilitation. Describe a situation where the combination of the soil conservation practices would be useful (Use sketches to illustrate). **15 marks**

(30 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 how the following conditions influence the amount of run-off water

i. Row crop /4

ii. Forested areas /6

10 marks

(30 marks)

Question Four

a. Describe what are terrace channels and their importance in prevention of soil erosion? /6

b. Give four disadvantages of the conventional tillage system. /4

10 marks

c. Calculate the total energy derived from the rainfall information presented in the table below:

Kinetic energy: $E = 12.1 + 8.9 \log i$

Time from start (minutes)	**Rainfall (mm)**	**Rainfall intensity (mm/h)**	**Kinetic energy ($J/m^{2/}mm$)**	**Total energy (J/m^2)**
0 - 15		7.52		
15 - 30		18.09		
30 - 45		60.20		
45 - 60		42.42		

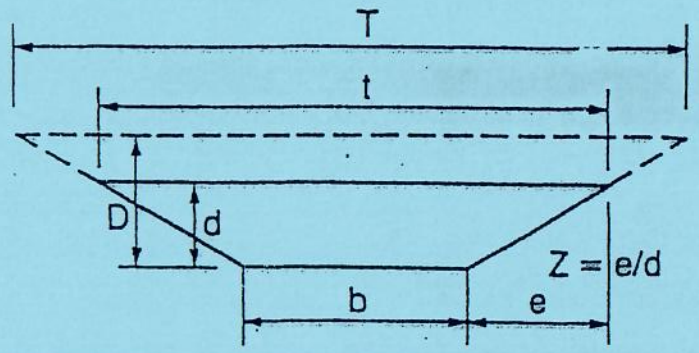
15 marks

c. Explain the relevance of crop management factor when estimating the amount of soil loss in an area.

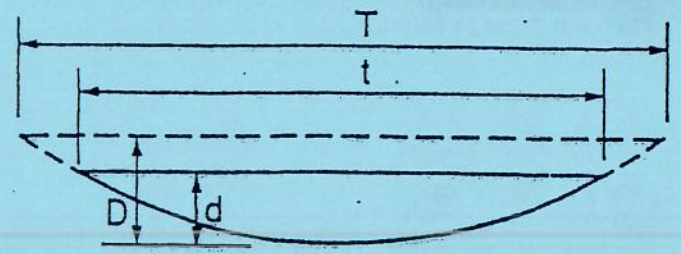
5 marks

(30 marks)

APPENDIX 1



Area	$bd + Zd^2$
Wetted perimeter	$b + 2d\sqrt{1 + Z^2}$
Hydraulic radius	$\frac{bd + Zd^2}{b + 2d\sqrt{1 + Z^2}}$
Top width	$t = b + 2dZ$ $T = b + 2DZ$



Area	$\frac{2}{3}td$
Wetted perimeter	$t + \frac{8d^2}{3t}$
Hydraulic radius	$\frac{t^2d}{1{\cdot}5t^2 + 4d^2}$ (approx.) $\frac{2d}{3}$
Top width	$t = \frac{3a}{2d}$ $T = t(\frac{D}{d})^{\frac{1}{4}}$

Basic dimensions of common channel sections