UNIVERSITY OF SWAZILAND
DEPARTMENT OF GEOGRAPHY ENVIRONMENTAL SCIENCE AND PLANNING

FINAL EXAMINATION PAPER: MAY 2006
B.Sc. IV

TITLE OF PAPER: **SOIL EROSION AND CONSERVATION**

COURSE CODE: **GEP 413**

TIME ALLOWED: **3 HOURS**

INSTRUCTIONS: **1. ANSWER THREE (3) QUESTIONS INCLUDING QUESTION ONE WHICH IS COMPULSORY.**

MARKS ALLOCATION: **1. QUESTION ONE (1) CARRIES 40 MARKS**
2. THE OTHER QUESTIONS CARRY 30 MARKS EACH.

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SECTION A: COMPULSORY QUESTION

QUESTION 1

a) The Universal Soil Loss Equation (USLE) predicts the long term average annual rate of erosion on a field slope based on rainfall pattern, soil type, topography, crop system and management practices. Outline the USLE equation, and discuss the function of each of the five major factors which are used to calculate the soil loss for a given site. (20 marks)

b) Discuss methods that can be utilised in the field to maintain soil fertility and ensure erosion protection. (20 marks)

(40 marks)

SECTION B: ANSWER ANY TWO QUESTIONS

QUESTION 2

a) The Rational Formula is used to estimate runoff from a catchment. Using the formula, estimate the runoff from a catchment with the following characteristics:

Catchment size: 12.45 km^2
Rainfall in the catchment was measured as 66 mm over a rain event lasting 33 minutes.
Catchment characteristics are described as gently undulating with a predominantly sandy texture interspersed with patches of dense woodland.

Values of runoff coefficient C (from Schwab *et al.* 1981)

Topography and vegetation	Soil texture		
	Open sandy loam	Clay and silt loam	Tight clay
Woodland	0.10	0.30	0.40
Flat 0-5% slope	0.25	0.35	0.50
Rolling 5-10% slope	0.30	0.50	0.60
Hilly 10-30% slope			
Pasture	0.10	0.30	0.40
Flat	0.16	0.36	0.55
Rolling	0.22	0.42	0.60
Hilly			
Cultivated	0.30	0.50	0.60
Flat	0.40	0.60	0.70
Rolling	0.52	0.72	0.82
Hilly			
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

The rational formula is:

$$Q = \frac{CIA}{360}$$

where:

Q is the rate of runoff in cubic metres per second,
I is the intensity in millimetres per hour,
A is the catchment area in hectares,
C is a dimensionless runoff coefficient (use table of values). (10 marks)

b) Describe the constraints faced by Chiefs in Swaziland and other traditional leaders in controlling soil erosion within their areas of jurisdiction. (20 marks)
(30 marks)

QUESTION 3:

a) Describe the basic principle of agronomic conservation for good crop husbandry. (10 marks)
b) Discuss three common problems associated with dam sites and five methods of preventing or managing such problems. (20 marks)
(30 marks)

QUESTION 4:

a) Briefly describe two methods for obtaining suspended load samples from a river and one method for determining the bed load of a river. (15 marks)
b) The aims of soil management are to maintain the fertility and structure of the soil to protect against erosion. Briefly describe this approach. (15 marks)
(30 marks)

QUESTION FIVE

a) Discuss why in Swaziland, soil erosion is considered to be low on arable land yet high on grazing land. (15 marks)
b) Describe the factors that control the rate and magnitude of soil erosion by wind. (15 marks)
(30 marks)