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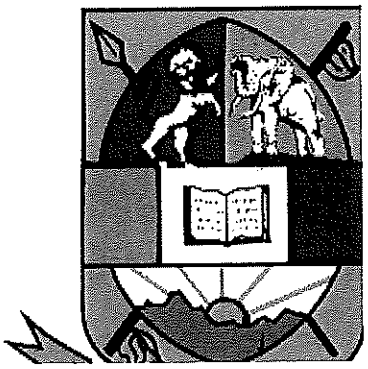

UNIVERSITY OF ESWATINI

SPECIAL ASSESSMENT

PROGRAMME: BACHELOR OF SCIENCE IN AGRONOMY, YEAR 2

COURSE CODE: **CPR 205**

TITLE OF PAPER: **INTRODUCTION TO SOIL SCIENCE**

TIME ALLOWED: **2 HOURS**

INSTRUCTIONS: **ANSWER ALL QUESTIONS**

DO NOT OPEN THIS QUESTION UNTIL PERMISSION HAS BEEN GRANTED BY THE INVIGILATOR

QUESTION 1

Given the values of percentage sand, silt and clay contents below (Table 1), use the Soil Textural Triangle given (Fig 1) to determine the soil texture **(18 Marks).**

Table 1: Percentage Sand, Silt and Clay Contents from a soil at Luyengo, Swaziland

Depth (cm)	Sand (%)	Silt (%)	Clay (%)	Soil Texture Classification
0-20	26	35	39	
21-45	89	7	4	
46-76	64	19	17	
77-90	9	6	85	
90-120	14	45	41	
0-20	5	87	8	
21-45	25	50	25	
46-76	8	35	57	
77-90	40	8	52	

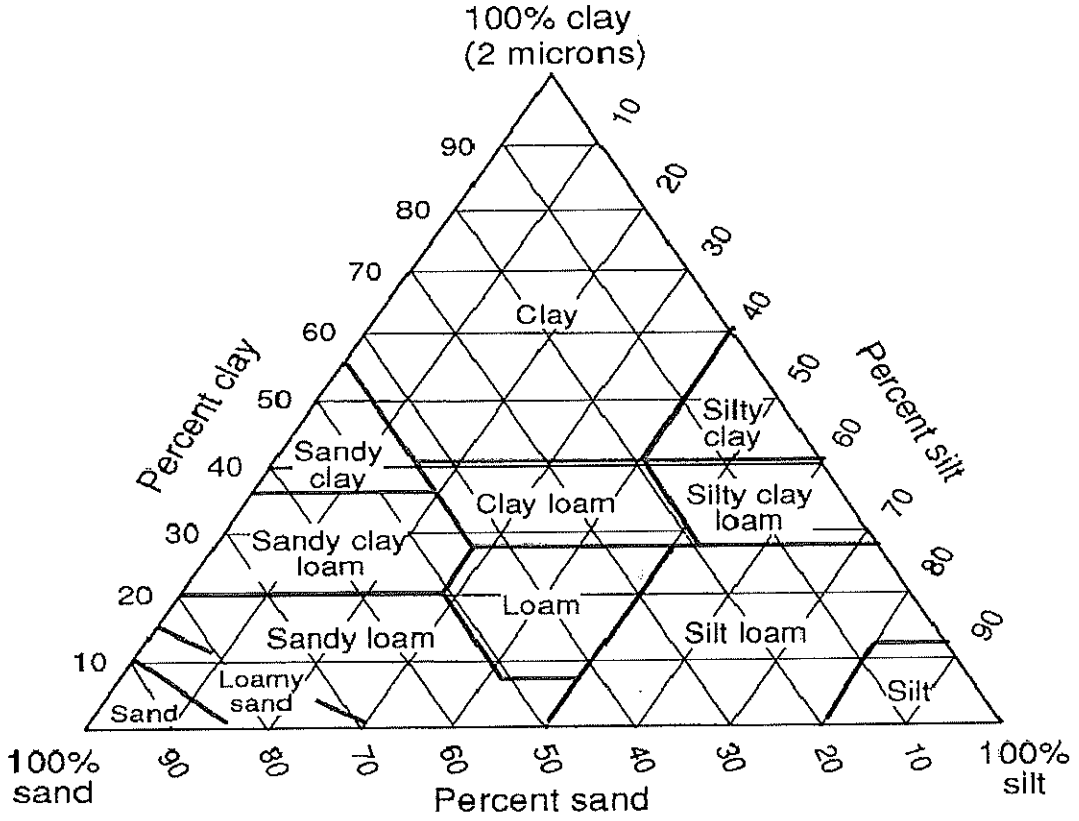

Fig 1: Soil Textural Triangle

Section B (82 Marks)

QUESTION 2

Given the table below (Table 2), briefly sate the properties of the Silicate Clay Mineral groups in terms of layer type, surface area and the CEC values (**30 Marks**).

Table 2: Characteristics of selected clay minerals

Group	**Layer Type**	**Surface area**	CEC values (cmol/kg)
Kaolinite			
Illite			
Vermiculite			
Smectite			
Chlorite			

QUESTION 3

Given the data below (Table 3), calculate the soil organic matter contents of these soils (**4 Marks**). What are the implications of these results for managing these soils for maize production in Luyengo, Swaziland (**20 Marks**)?

Table 3: Selected Soil properties

Soil series	Depth (cm)	Organic C (%)	SOM%	Soil Texture	Bulk density (g/cm3)	Porosity %
A- set	0-20	1.20		Clay	1.00	
A- set	20-60	1.90		Loam	1.51	
B-set	0-10	2.13		Sandy loam	1.41	
B-set	10-45	0.34		Sandy clay loam	1.50	

Particle density =2.65g/cm^3

QUESTION 4

What is a pedon? Distinguish between a pedon and a soil profile **(4 Marks)**.

Mention the two main sources of charge in clay minerals **(4 Marks)**.

What are the sources of negative charges within the soil **(4 Marks)**?

Soil Texture determination is based on Stokes Law. Briefly state this law **(5 Marks)**.

QUESTION 5

Given that data on the sand, silt, clay, base cations (Ca, Mg, K, and Na), and cation Exchange capacity (CEC) as shown in for four soil types (i.e. (Thabana, Berea, Calendon, Leribe and Popa) in Table 4:

(i) Calculate the Sand (%), Silt (%) and Clay (%),
(ii) Calculate the base saturation percentage and
(iii) Calculate the effective cation exchange capacity (ECEC).
(iv) Calculate the silt: clay ratio **(15 Marks)**.

Table 4: Selected soil properties in four soil types, Luyengo, Swaziland

Soil series	Sand (%)	Silt (%)	Clay (%)	Ca	Mg	K	Na	CEC	ECEC
	----------%----------			----- cmol/kg-----					
Thabana		14.4	7.00	0.5	0.2	0.2	0.1	8.6	
Berea	58.1		16.80	0.2	0.2	0.1	0.1	15.8	
Leribe		31.8	18.00	0.6	0.3	0.02	0.2	2.90	
Popa	30.6	27.6		0.1	0.1	0.15	0.1	34.9	