UNIVERSITY OF ESWATINI

Final Examination Paper

Programme: Bachelor of Science in Agronomy, Year 4

Course Code: **CPR 402**

Title of Paper: **Soil Management**

Time Allowed: **2 hours**

Instructions: **Answer FOUR questions. <u>Question 1 is compulsory.</u>**

Do Not Open This Question until Permission has been granted by the Invigilator

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Question 1:

Data presented below (Table 1) showed irrigation water from five major rivers in Swaziland: (i) Komati River, (ii) Mlumati River, (iii) Mbuluzi River, (iv) Tembe River, and (v) Lusutfu River.

Table 1: Irrigation water quality of selected rivers in Swaziland

S/No	Rivers	Ca^{2+}	Mg^{2+}	K^+	Na+	HCO_3^{2-}	CO_3^{2-}	SAR	SSP	RSC	KR
		------------------- meq/l------------------------							-%-	Meq/l	
1	Komati River	0.15	0.52	1.08	10.87	10.65	10.33				
2	Komati River	0.17	0.62	1.09	11.08	10.78	10.51				
3	Mlumati River	0.15	0.58	1.10	10.82	10.70	10.43				
4	Mlumati River	0.14	0.58	1.12	11.26	10.25	10.00				
5	Mlumati River	0.14	0.54	1.11	10.87	10.44	10.19				
6	Mbuluzi River	0.15	0.56	1.09	10.87	10.79	10.42				
7	Mbuluzi River	0.15	0.54	1.08	11.00	10.79	10.50				
8	Mbuluzi River	0.15	0.59	1.10	11.22	10.64	10.33				
9	Tembe River	0.15	0.58	1.08	11.17	10.66	10.33				
10	Lusutfu River	0.14	0.58	1.10	11.04	10.69	10.33				

SAR= sodium absorbtion ratio; SSP= sodium soluble percentage; RSC= residual sodium carbonate; and KR= Kelly ratio.

a. Calculate the following:
i. Sodium Absorption Ratio (SAR)
ii. Sodium Soluble Percentage (SSP)
iii. Residual Sodium Carbonates (RC) and
iv. Kelly's ratio
b. From the calculated values, which of waters would be suitable for irrigation of 100 ha of sugarcane plantation? Give reasons for your answers.

[25 Marks]

Question 2:

a. Distinguish between natural and technical soil classification with one example each.
b. Mention two importance of using technical soil classification to manage soils.
c. Write short notes on the following:
i. Land Capability Classification
ii. Land Suitability Evaluation
iii. Fertility Capability Classification
iv. Parametric Systems of Evaluation

[25 Marks]

Question 3:

Most of the soils in Swaziland are classified as **Oxisols** or **Ferralsols**.

    a. Itemize and discuss factors that are responsible for the formation of this Soil Order.
    b. What are the main limitations of this Soil Order and how can you manage or ameliorate them for maize production in Luyengo Campus?

[25 Marks]

Question 4:

    a. What are the causes of soil salinity and soil sodicity?
    b. State five visual symptoms that will show that a given soil has excessive salts (i.e. saline, saline-sodic, and sodic soils).
    c. Data presented in Table 2 showed a soil profile data from the RSSC, Swaziland. Calculate the following: (i) Sodium Absorption Ratio (SAR) and (ii) Effective Cation Exchange Capacity (ECEC) of the four horizons. Present your data in a tabular form.
    d. From the data, which soil properties will indicate that this soil is sodic? How will you manage these problems? Explain.

Table 2: Extractable cations, and cation exchange capacity of an S-set soil, Mhlume, Swaziland

Horizon	Depth (cm)	Na^+	Mg^{++}	K^+	Ca^{++}	CEC	SAR	ECEC
		------------- cmol (+)/kg -------------					meq/l	-cmol/kg
Ap	0-28	20.80	0.80	2.31	0.62	12.30		
Bt1	28-55	19.10	1.60	1.13	0.66	11.30		
Bt2	55-90	17.30	0.50	0.64	0.75	10.20		
Bt3	90-115	18.0	0.70	0.54	0.97	15.20		

CEC = caution exchange capacity; SAR= Sodium Absorption Ratio

[25 Marks]

Question 5:

    a. What is the difference between soil acidity and soil alkalinity?
    b. Describe briefly how you will determine soil pH in water from a soil sample.
    c. Itemize and briefly discuss **five** causes of soil acidity in soils of Swaziland.
    d. Discuss the effect of soil pH on (i) soil nutrients and (ii) soil microbiology.

[25 Marks]

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