

**UNIVERSITY EXAMINATIONS****FIRST SEMESTER 2025/2026 ACADEMIC YEAR****FIRST YEAR EXAMINATION FOR THE DEGREE OF
BACHELOR OF AGRICULTURAL EDUCATION AND
EXTENSION, BACHELOR OF ENVIRONMENTAL SCIENCE
AND AGECE****NAR 113: INTRODUCTION TO SOIL SCIENCE*****STREAM:R******TIME: 2 HRS******DAY: WEDNESDAY [11.30 – 13.30 P.M]******DATE: 04/02/2026*****THIS QUESTION PAPER CONSISTS OF THREE (3) PAGES****PLEASE DO NOT OPEN UNTIL THE INVIGILATOR SAYS SO.**

ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS**QUESTION ONE (30 MARKS)**

a) Define the following terms

(i) Soil Colloid (2 Marks)

(ii) Soil pedon (2 Marks)

(iii) Isomorphous Substitution (2 Marks)

(iv) Percent Base Saturation (2 Marks)

(v) Soil carbon sequestration (2 Marks)

b) Humus is a key component of stable SOM. Compare and contrast the three main humic substances (Fulvic acid, Humic acid, and Humin) based on their molecular weight, decomposability, and solubility.

(6 Marks)

c) List **FIVE** master horizons described in soil classification. (5 Marks)d) Calculate the percentage pore space of a soil sample with a bulk density (D_b) of 1.5 g/cm^3 and a particle density (D_p) of 2.65 g/cm^3 . Show your working. (4 Marks)e) Name **FIVE** types of physical weathering processes. (5 Marks)**QUESTION TWO (20 MARKS)**a) Discuss **FIVE** diagenetic processes involved in formation of sedimentary rocks. (10 Marks)b) A soil sample has the following exchangeable cation data: $\text{Ca}^{2+} = 8.0 \text{ cmolc/kg}$, $\text{Mg}^{2+} = 2.0 \text{ cmolc/kg}$, $\text{K}^+ = 0.4 \text{ cmolc/kg}$, $\text{Na}^+ = 0.1 \text{ cmolc/kg}$, and $\text{Al}^{3+} = 2.0 \text{ cmolc/kg}$.

(i) Calculate the Effective Cation Exchange Capacity (ECEC) of this soil. (3 Marks)

(ii) Calculate the Percent Base Saturation. (2 Marks)

QUESTION THREE (20 MARKS)

"Cation Exchange Capacity (CEC) is a fundamental property influencing soil fertility." Discuss this statement by explaining:

(i) The factors that determine a soil's CEC. (7 Marks)

(ii) The relationship between CEC, nutrient availability, and nutrient antagonism. (4 Marks)

(iii) Why a soil's CEC generally increases with rising pH. (4 Marks)

QUESTION FOUR (20 MARKS)

- a) Soil texture is a stable property that profoundly influences a soil's physical behaviour.
- i) Compare and contrast the physical properties of sand, silt, and clay separates in terms of their surface area, water holding capacity, and permeability. (You may use a table for your answer). **(9 Marks)**
- ii) Describe the "feel method" for determining soil texture in the field, explaining how the behaviour of a moist soil ball can help distinguish a sandy loam from a clay loam. **(6 Marks)**

QUESTION FIVE (20 MARKS)

- a) Outline **SEVEN** types of surveys based on scale of mapping indicating for each their purpose and scale. **(11 Marks)**
- b) Name **three** major global soil classification systems. **(3 Marks)**
- c) Define soil survey. **(1 Marks)**