MANICALAND STATE UNIVERSITY OF APPLIED SCIENCES

FACULTY OF AGRIBUSINESS AND COMMERCE

DEPARTMENT OF AGRICULTURE ECONOMICS AND DEVELOPMENT

INTRODUCTION TO SOIL SCIENCE

CODE: AEDT125

SESSIONAL EXAMINATIONS
OCTOBER 2021

DURATION: 3 HOURS

EXAMINER: Mr N. SAKADZO

INSTRUCTIONS

1. *Answer any **Four** questions*
2. *Be concise and clear*
3. *Total marks 100*

Question 1

a) Discuss the following factors that influence soil formation:

i) Organisms **[5]**

ii) Time **[5]**

b) Describe properties of a named 1:1 aluminosilicate clay **[10]**

c) With aid of a diagram describe the structure of montmorillonite. **[5]**

Question two

a) Define soil pH. **[2]**

b) Explain the notion that aluminium ions act as a source of indirect hydrogen ions (H^+) and therefore become a source of acidity in soils. **[8]**

c) Indicate, giving reasons the pH values that would you expect for the following soils:

i) Soils in arid areas receiving less than 500mm rainfall per annum. **[5]**

ii) Soils in humid climate receiving about 1200mm rainfall per annum **[5]**

d) Differentiate between a pH dependent charge and a permanent charge in aluminosilicate clays. **[5]**

Question three

a) A farmer intended to grow maize on his farm. He collected a soil sample using a core measuring 100mm in diameter and 60mm height. After oven drying, the mass of the soil sample was 520g.

i) Calculate the bulk density of the soil in Mg m^{-3}. **[7]**

ii) Explain the low bulk densities exhibited in clay soils. **[2]**

b) Discuss **two** factors which affect soil aeration. **[10]**

c) Describe three ways which destroy soil structure. **[6]**

Question four

a) Explain why nitrogen fertilizer is susceptible to leaching in soils. **[4]**

b) Describe **three** methods that can be used to control nitrogen fertilizer loss by leaching in cropping systems. **[6]**

c) Explain **five** strategies that can be used to enhance phosphorous availability to crops in light sandy soils. **[15]**

Question five

a) Given

Exchangeable Ca ($mmoles_c\ Kg^{-1}$) =50
Exchangeable Mg =45
Exchangeable K =3
Exchangeable Na =1
Exchangeable H =12
Exchangeable Al =39

Calculate the following:

i) Cation Exchange Capacity (CEC) **[2]**
ii) Total Exchangeable bases (TEB) **[2]**
iii) % Base Saturation **[2]**
iv) Sodium Adsorption Ratio (SAR) **[2]**
v) Exchangeable Sodium Percentage (ESP) **[2]**

b) Describe the two steps that are involved in the process of nitrification in soils. **[8]**

c) Write short notes on the following:

i) Symbiotic Biological Nitrogen Fixation **[4]**
ii) Mycorrhizae Symbiosis **[3]**

END OF EXAMINATION