

30



**MASINDE MULIRO UNIVERSITY OF  
SCIENCE AND TECHNOLOGY  
(MMUST)  
SCHOOL OF AGRICULTURE, VETERINARY SCIENCES AND  
TECHNOLOGY (SAVET)**

**MAIN CAMPUS**

**UNIVERSITY EXAMINATIONS  
2023/2024 ACADEMIC YEAR**

**MAIN EXAMS  
OF  
BACHELOR OF AGRICULTURE AND BIOTECHNOLOGY**

**COURSE CODE: ASS 204**

**COURSE TITLE: SOIL PHYSICS AND CHEMISTRY**

**DATE: 15.12.23**

**TIME: 3-5PM**

---

**INSTRUCTIONS TO CANDIDATES**

This paper is divided into two sections, **A and B**. Answer ALL Questions in SECTION A and any Two in SECTION B

*MMUST observes ZERO tolerance to examination cheating*

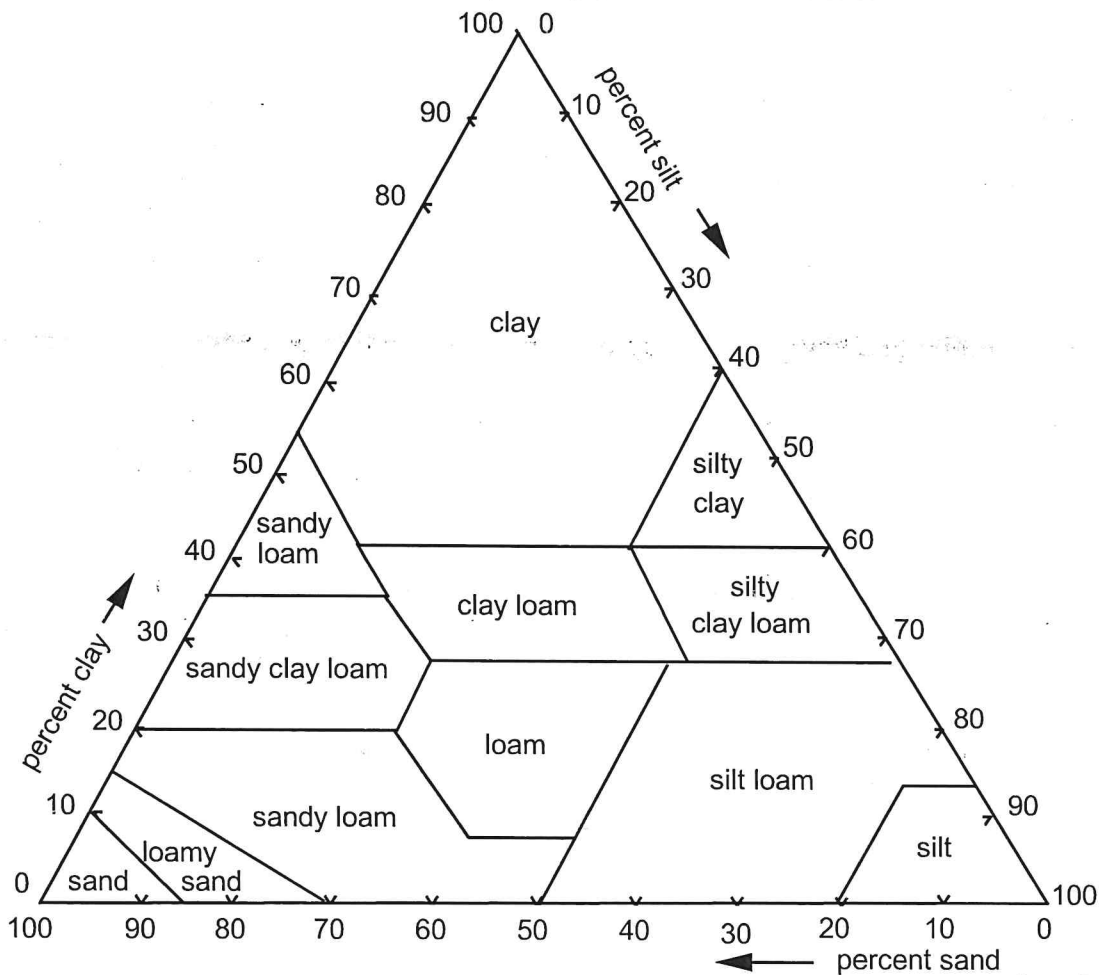
*This Paper Consists of 4 Printed Pages. Please Turn Over*

**SECTION A: ANSWER ALL QUESTIONS (30 MARKS)**

**QUESTION ONE = 30 MARKS (COMPULSORY)**

a) A soil is sampled by a core measuring 6.8 cm in diameter and 8.6 cm deep. The core weighs 280 g. The total core plus wet soil weight is 1150 g. On oven drying at 105° C the core plus dry soil weighed 940 g. Calculate Wet and Dry bulk densities and Gravimetric moisture contents. (6 Marks)

b) 50.0 g of air-dry soil sample is weighed and after 40 seconds the hydrometer reading corrected for temperature is 23.0 g per litre. After 2 hours, a hydrometer reading after temperature correction is 9.4 g/litre. Calculate percentage sand, silt, and clay and obtain the appropriate textural class of the soil sample using the diagram below. (8 Marks)



c) Calculate the water capillary height in soil using the following data; Contact angle

$30^\circ$ , surface tension = 0.58n/m, radius = 0.04m. (3 Marks)

d) Agriculture student got the following results from the lab analysis:

Initial soil mass = 50g

Mass of sand = 27%

Mass of soil retained = 13g

Calculate the aggregate stability of the soil (3 Marks)

e) 90g of dry soil has a total surface area of  $30\text{m}^2$ . The volume of solids is  $45\text{m}^3$  and the volume of fluids is  $35\text{m}^3$ . Calculate

i) Surface Area per unit Volume (2 Marks)

ii) Surface Area per unit Bulk Volume (2 Marks)

iii) Surface Area per unit Mass. (2 Marks)

f) State the validity and limitations of Darcy equation (4 Marks)

## SECTION B: ANSWER ANY TWO QUESTIONS (40 MARKS)

### QUESTION TWO = 20 MARKS

a) Classify soils particles according to the ISSS system (8 Marks)

b) Describe the swelling process in a Smectites clay soils (12 Marks)

### QUESTION THREE = 20 MARKS

a) Explain various approaches that are used to describe soil structure (12 Marks)

b) Describe the different forces and binding agents involved in aggregation during soil

structural formation

(8 Marks)

**QUESTION FOUR = 20 MARKS**

a) Discuss the Atterbergs Limits.

(8 Marks)

b) Describe the Stages of soil drying during Evaporation

(12 Marks)

**QUESTION FIVE = 20 MARKS**

The following data was obtained from a Ring Infiltrometer Test of a clay-loam soil.

Time, t (minutes)	Cumulative Infiltration depth, I (cm)
1	0.62
15	3.45
30	4.95
60	7.37
150	14.63
200	15.94

Use Kostiakov's Infiltration Equation to determine the following:

(i) The constants in the equation

(12 Marks)

(ii) Cumulative infiltration after 4 hours

(4 Marks)

(iii) Instantaneous infiltration after 4 hours

(4 Marks)