



**KISII UNIVERSITY**  
**UNIVERSITY EXAMINATIONS**  
SECOND YEAR EXAMINATION FOR THE AWARD OF THE  
DEGREE OF BACHELOR OF SCIENCE IN AGRICULTURE  
FIRST SEMESTER 2022/2023  
(SEPTEMBER - DECEMBER, 2022)

**SOIL 211: SOIL CHEMISTRY**

**STREAM: Y2 S1**

**TIME: 2 HOURS**

**DAY: FRIDAY, 12:00 P.M – 2:00 P.M**

**DATE: 23/12/2022**

**INSTRUCTIONS:**

- 1. Do not write anything on this question paper.**
- 2. Answer ALL Questions in section A (Compulsory) and any other TWO Questions in section B.**

**SECTION A: (30 MARKS)**

1. Explain the following concepts:
  - a) Geometry of the basic building blocks of primary minerals. (2 marks)
  - b) Isomorphous substitution. (2 marks)
2. List the four classes of primary minerals based on the arrangement of the basic building blocks and briefly explain the arrangement in each case. (8 marks)
3. Outline the major factors that show the importance of
  - a) Soil organic matter. (3 marks)
  - b) Oxygen functional groups in humic substances. (3 Marks)
4. a) Give the three meanings of the term CLAY in soil usage. (3 marks)  
 b) List the major general characteristics of soil colloids. (3 marks)
5. Briefly explain the following:
  - a) Iron and aluminium oxide clays. (3 marks)
  - b) Humus colloids. (3 marks)

**SECTION B: (40 Marks)**

6. a) Based on the structural arrangement and their properties, discuss the differences between 1:1 and 2:1 silicate clays. (14 marks)
- b) Give an example of each of the silicate clays in (a) above and state at least two uses of soils dominated by these clays. (6 marks)
7. a) Explain the two major types of charge on soil colloids, indicating their sources. (8 marks)
- b) Discuss five principles governing cation exchange reactions in soil. (12 marks)
8. a) Define soil pH and explain the three major pools of soil acidity common in soils. (5 marks)
- b) Explain and illustrate using equations five of the processes by which acidity may develop in a soil. (15 marks)