CHUKA **UNIVERSITY**

UNIVERSITY EXAMINATIONS

SECOND YEAR EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE IN AGRICULTURE

SOIL 210: SOIL PHYSICS

STREAMS: BSC AGRIC Y2S1   **TIME: 2 HOURS**

DAY/DATE: THURSDAY 06/12/2018   **8.30 P.M – 10.30 A.M**

 INSTRUCTIONS
- **Answer all questions in section A and any other two in section B**

SECTION A: ANSWER ALL QUESTIONS

1.   (a) Calculate the number of particles in $1 cm^3$ and specific surface of 1 g particle of soil with 10^{-3} cm cubical side, given: $p_s = 2.65$ g cm^{-3}.   [6 marks]

(b) Derive the universal soil loss equation.   [4 marks]

2.   (a) Discuss the signs and symptoms of soil compaction as observed on plants in a field.   [4 marks]

(b) Distinguish between sticky limit and upper limit of viscous flow as applied in soils.   [4 marks]

3.   (a) Describe the phases of soils.   [3 marks]

(b) Sate the Stefan-Bo;tzmann law and calculate how much heat a gleysol with an emissivity of 0.61 at temperature of 29°C radiates per second in a 4.5 x5.2m surface area.   [4 marks]

Given :

Emmisivity of the surface; 1 for blackbody k for other bodies

Stefan-Boltzmann constant = 5.67 x $10^{-8} Js^{-1}$ or W/$m^2 K^4$,

4.   (a) Discuss any two water quality contaminants related to agricultural productivity.

                                                                                          [2 marks]

        (b) Describe the simultaneous transport of water and heat in soils.   [3 marks]

SECTION B:ANSWER TWO QUESTIONS

5.   (a) Describe the means by which water is held in soil.   [6 marks]

        (b) Explain how modification of soil thermal regime is achieved in crop production.

                                                                                          [6 marks]

        (c) Discuss any eight (8) factors affecting soil aeration.   [8 marks]

6.   (a) The gravimetric water copnent w, of a sample of moist soil is measured by weighing

        the moist soil sample, drying it to remove water, and reweighing it. The customary

        method of drying is to place the sample in an oven at 105° C for 24h. Given the following

        calculate the soil moisture and content, state the problem of applying this method.

                                                                                          [8 marks]

        Mass of can + moist soil 174g

        Mass of can +dry soil 152 g

        Mass of empty can 32g

        (b) Explain the adverse effects of suboptimal aeration on plants and soils. [6 marks]

        (c) Explain the soil thermal properties.   [6 marks]

7.   (a) Explain the main principles applied in conservation tillage.   [8 marks]

        (b) Illustrate the soil moisture retention in sand, silt and textured soils.   [6 marks]

        (c) Given the following, estimate the deep drainage (D) losses in the field using the soil

        water balance equation.   [6 marks]

        Soil = Andosols   crop = Bulrush   Area =4 ha

        Period = 12 October (sowing data) to 32 December (harvesting)

        Given :

        Soil moisture in the profile on Oct 12 (M1) = 115 mm

        Precipitation or rainfall (P) = 755

        Irrigation (I) = Nil

        Contribution from ground water (C) = Nil

        Evapotranspiration (estimated) (ET) = 325 mm

Run –off of 200 cubic m from 4 ha field (RO) = 45 mm

Soil moisture in the profile on Dec 31 (M2) = 75 mm