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**EMBU UNIVERSITY COLLEGE**

**(A CONSTITUENT COLLEGE OF THE UNIVERSITY OF NAIROBI)**

**SECOND SEMESTER EXAMINATION 2013/2014**

**SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN WATER RESOURCE MANAGEMENT AND BACHELOR OF SCIENCE MANAGEMENT OF AGRO-ECOSYSTEMS & ENVIRONMENT**

**ASS 202: ENVIRONMENTAL SOIL PHYSICS**

**DATE: APRIL 2, 2014** **TIME: 11.00AM - 1.00PM**

**INSTRUCTIONS:**

**Answer Question ONE and ANY Other TWO Questions.**

**QUESTION ONE**

a.) Explain the meaning of the following terms as used in environmental soil physics.

i.) Specific surface (2 Marks)

ii.) Volume wetness (2 Marks)

iii.) Soil structure (2 Marks)

iv.) Hygroscopic water (2 Marks)

b.) Soil structure is highly dynamic and may change greatly from time to time. What factors are responsible for this?

(3 Marks)

c.) Explain the factors that affect adsorption of fluids on soil surfaces (4 Marks)

d.) A soil sample taken in the field exactly fills a cylinder which is 7.5 cm long with an internal volume of 179 $cm^3$. When dried it is found that the dry mass is 286g and that the mass of the water driven off is 54g. If the soil particle density is 2.66 g $cm^{-3}$, calculate:

i.) Air-filled porosity (4 Marks)

ii.) Void ratio (2 Marks)

e.) Distinguish between water balance of the root zone and potential evapotranspiration for a soil of given surface properties. (4 Marks)

f.) State the factors that that cause water stress in soils. (5 Marks)

## QUESTION TWO

a.) Briefly explain the goals of environmentalism.

(12 Marks)

b.) Explain how aggregated soil structures can be characterized quantitatively. (8 Marks)

## QUESTION THREE

a.) You have been appointed as Soil Physicist by National Agricultural Laboratories and a farmer comes seeking information on the quantitative physical characterization of his farm soil. Explain the factors consider in determining the choice of method to use? (8 Marks)

b.) Write short notes on the following:

i.) Tortuosity (4 Marks)

ii.) Surface tension (4 marks)

iii.) Viscosity (4 marks)

## QUESTION FOUR

a.) A one-dimensional flow of water through a saturated homogeneous soil can be estimated using the Darcy equation. Identify the various parameters of this equation. (6 marks)

b.) Compute the weekly evaporation from a reservoir using the water-budget method from the following data recorded during the week: Average inflow into the reservoir = 32.5 $m^3/s$, Average outflow from the reservoir = 40.2 $m^3/s$, Rainfall during the week = 73.6 mm, Average waterspread area = 15.8 $km^2$, Estimated seepage = 0.25 million $m^3$, Storage at the beginning of the week = 9180 ha-m, and Storage at the end of the week = 8630 ha-m. (14 Marks)

**QUESTION FIVE**

a.) Describe ways by which evapotranspiration may be controlled in marginal areas. (10 Marks)

b.) Explain the factors that affect absorption of water by plant roots from the soil. (10 Marks)

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