KERALA AGRICULTURAL UNIVERSITY
B. Tech. (Agrl. Engg.) 2021 Admission
V Semester Final Examination – January 2024

Iden.3108 **Drainage Engineering (1+1)** **Marks: 50**
Time: 2 hours

I **Fill in the blanks** **(10x1=10)**

1. Salt concentration in soil ..... with depth following an irrigation event.
2. Piezometers are used to record .....
3. Cation Exchange Capacity is expressed in .....
4. When the leaching fraction increases, the leaching requirement .....
5. Er nst's equation is applicable to ..... soil profile

State True or False

6. Random drain system is the most effective one among surface drainage methods.
7. Cypress creek formula is used for flat lands having slope more than 0.5%.
8. Geometry factor of radial resistance is unity when the drain is in the top layer and hydraulic conductivity of top layer is 10 times more than that of bottom layer
9. Mole drainage is recommended for all types of soils.
10. When the transpiration requirement of plant is met from available soil moisture in the root-zone, the process is called bio-drainage

II **Write short notes on ANY FIVE of the following** **(5x2=10)**

1. Volume of water drained through sub-surface drains from a field of 1 ha area is 432 m^3. At the same time the volume of soil drained is found to be 4000 m^3. Calculate the drainable porosity of the soil.
2. Differentiate between water table contour map and isobath map
3. What is skimming well concept and where it is used?
4. Six grams of NaCl is dissolved in 2 litres of water. Express the concentration of NaCl in mmhos/cm and meq/litre.
5. Estimate the mass of salt added in kg to a land of 1 ha area due to application of 30 ha.cm of irrigation water having electrical conductivity of 0.9 dS/m.
6. Prove that the depth of irrigation increases with increase in leaching fraction.
7. Calculate the ESP of a soil, when the concentrations of Na^+, Ca^{++} and Mg^{++} are 16.5, 5.2 and 4.3 meq/L respectively, in the soil solution.

III **Answer ANY FIVE of the following** **(5x4=20)**

1. Make a list of drainage materials used in sub-surface drainage system and explain their functional requirements in brief.
2. Discuss about the concept of 'equivalent depth' in Hooghoudt equation. What are the methods used to determine it?
3. Discuss about the problems likely to develop in the soil due to salt affliction.
4. Concentration of salts in a sample of 1 litre of irrigation water are as follows:

Constituents	Ca	Mg	Na	HCO_3	CO_3	SO_4	Cl
mg	61.8	42.3	376.4	498.2	33.5	251.6	323.9

EC of the irrigation water is 1.2 mmhos/cm. Comment on the class and suitability of the water for irrigation.

5. Discuss the important parameters need to be investigated prior to planning sub-surface drainage system.
6. How does the geometry factor of radial resistance in Ernst's equation change with the change in hydraulic properties of soil layers and position of the drain?
7. Prove that the size of the tile drain (d) in subsurface drainage system $d = 0.0218\frac{(n\,D_c LW)^{3/8}}{(S)^{3/16}}$

where, d = diameter of the tile; n = manning's roughness coefficient; Dc = Sub-surface drainage coefficient; L = Length of the tile drain; W = spacing between two tile drains and S = grade of the tile drain.

IV **Write an essay on ANY ONE of the following** **(1x10=10)**

1. In a two layered soil profile, tile drains with a diameter of 0.1 m are located in the top layer at 1 m above the interface between the two layers. Thickness of bottom layer is 4 m. The hydraulic conductivity of the top layer is 0.5 m d^{-1} and that of the bottom layer is 2.0 m d^{-1}. The geometry factor of radial resistance (a) obtained from relaxation table is 3.9. Calculate the drain spacing between tile drains, when the hydraulic head is 0.7 m and drainage discharge is 0.007 m^3 d^{-1}.
2. Derive Hooghoudt's equation for spacing between the drains in a homogeneous soil. Prove that the Hooghoudt equation also describes an ellipse equation.

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