Marks: 50

Time: 2 hours

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

1   The sum of pressure head and gravitational head is called as --------- head.

2   Drainage removes only the ---------type of water from the soil.

3   Unit of intrinsic permeability is ---------

4   Drainage coefficient is the depth of water removed in ---------period.

5   In isotropic soil, hydraulic conductivity is --------- in all directions.

State True or False

6   Isobath lines are the lines of equal depth of water table.

7   Platy structure of soil offers favorable drainage characteristics.

8   An open ditch if extended below water table removes subsurface ground water.

9   The depth of field drain is governed by outlet conditions.

10   Clayey soils are difficult to drain as compared to sandy soils.

II   **Write Short notes on any FIVE of the following**   (5x2=10)

1   Drainage area of 200 ha is draining water at outlet which is measured by rectangular weir having crest length of 50 cm. If depth of flow over crest is 40 cm, find drainage coefficient.

2   Differentiate between surface and sub-surface drainage system

3   Explain Bio drainage in brief.

4   Categorization of water logged areas with respect to depth of water table from the surface.

5 What are the drainage criteria for steady and unsteady state groundwater conditions?

6 Drainage canal discharges 0.3 m³ of water per second and drains 300 ha of area. Find the drainage coefficient.

7 Differentiate between observation well and piezometer

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

1 The drainable porosity of layer is 3.5 % and equivalent depth is 4.41 m. The hydraulic conductivity of the soil is 0.12 m/day. If irrigation depth of 20 cm is applied at moisture content 20 %. What will be the water table depth above drain, if the initial height of water table above the drain is 1.3m? **Given: Field capacity is 38 %, bulk density is 1.15 gm/cm³**

2 Describe functions of drain envelope and write down the materials used as envelopes for pipe drains.

3 What is vertical drainage? Give its advantages.

4 Neglecting resistance due to convergence of flow near the drain, compute the spacing of sub-surface drains in a field of clay loam soil with hydraulic conductivity of 0.6 m per day, when impervious layer is at 2.5m below the drains. Bottom of the drain and minimum water table level below the ground surface are 1.5 m and 1.2 m, respectively. The excess irrigation rate is equivalent to the drainage coefficient of 1.5 mm/day.

5 Calculate the most efficient bottom width for a drainage channel to carry a flow 2 m deep in a clay soil. Compute the velocity and discharge capacity of the channel, if channel gradient is 0.04 per cent. Recommended side slope for channel is 1:1, Manning's coefficient (n) is 0.035 and permissible velocity in the channel is 1.2 m/s for clay soil.

6 Explain the different components of drainage flow considered in Ernst equation.

7 Determine the size of clay tile required at the end of 500 m long tile line, if drainage coefficient is 1 cm, grade is 0.3 per cent and tile spacing is 50 m. (assume n = 0.0108)

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

1 Derive the Hooghoudt's equation with all its assumptions.

2 Enlist and explain different surface drainage systems.

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