Iden.4108   **Drainage Engineering (2+1)**

Marks: 50
Time: 2 hours

I **Fill in the Blanks**   (10x1=10)
1 Clay tiles are usually made in length of about _____ cm.
2 Drainage coefficient is the depth of water removed in _____ period.
3 Open well is an example of _____ type of drainage.
4 Electrical conductivity of saline soil is more than _____.
5 In homogeneous soil, hydraulic conductivity is same at _____
   State True or False
6 Glover-Dumm equation is used to determine drain spacing for steady state condition.
7 As per the norms given by Working Group, Govt. of India an area is said to be waterlogged, if water table depth is within 2 m from the land surface.
8 Minimum velocity of flow through tiles should be 0.4 m/s to keep the tile line flushed clear of silt.
9 Side slopes of drainage channel are determined by soil texture and stability.
10 Exchangeable sodium percentage of alkali soil is less than 15 per cent.

II **Write Short notes on any FIVE of the following**   (5x2=10)
1 Vertical drainage and its advantages.
2 Differentiate between observation well and piezometer
3 What precautions will you adopt to prevent salinity of irrigated land?
4 Drainage canal discharges 0.5 m³ of water per second and drains 500 ha of area. Find the drainage coefficient.
5 Interceptor drain.
6 Different layouts of pipe drainage systems.
7 Drainage area of 400 ha is draining water at outlet which is measured by rectangular weir having crest length of 40 cm. If depth of flow over crest is 50 cm, find drainage coefficient.

III **Answer any FIVE of the following.**   (5x4=20)
1 Bio-drainage.
2 Design an open ditch to drain 500 ha of land having the drainage coefficient of 3.5 cm. The soil is silt loam. The maximum permissible slope of the channel bed is 0.1 percent. The recommended side slopes are 1.5 : 1 (H : V) and the recommended maximum permissible velocity of flow for silt loam soil is 0.9 m/s. The depth of the ditch is 1.5 m.
3 A drainage coefficient of land is 2.2 m. Calculate required capacity of the outlet end of ditch draining watershed of 200 ha.
4 Mole drain.
5 How the problematic soils are classified according to EC, ESP and pH?
6 Describe functions of drain envelope and write down the materials used as envelopes for pipe drains.
7 What should be the drainage spacing in the following situation, so that the depth of water fluctuates between 0.8 m to 1.2 m below ground level and irrigation interval 15 days. The drainable porosity of layer is 3.5 % and equivalent depth is 4.41 m. The hydraulic conductivity is 0.12 m/day. The sub-surface drains are located at a depth of 2.5 m below the ground level.

IV **Answer any ONE of the following**   (1x10=10)
1 Derive the Hooghoudt's equation with all its assumptions.
2 Describe the Ernst equation with horizontal, vertical and radial flow components.
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