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ET-533(A)

B.Tech. Civil (Water Resources Engineering)

Term-End Examination

00275 **June, 2015**

ET-533(A) : IRRIGATION ENGINEERING

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **five** questions. Use of calculator is permitted. Assume any missing data suitably.*

1. (a) Describe the Border irrigation method with the help of a neat sketch. Compare it with Furrow irrigation for irrigating crops such as Maize. *6*

(b) A moist soil sample had volume of 465 cm^3 and its weight was 795 gm in its natural state. When it was dried in a hot air oven at 105°C for 24 hours, its weight was reduced to 730 gm. If the specific gravity of the soil was 1.5, determine porosity, moisture content, volumetric moisture content and degree of saturation of the soil sample. *8*

2. (a) Explain the term "Infiltration" and its importance in irrigation system design. *6*

(b) A small tube with a cross-section area of 30 cm^2 is fully filled with soil and kept horizontal. Open end of the tube is saturated and after 13 min, it is noted that a volume of 95 cm^3 of water has infiltrated into the tube. If the saturated hydraulic conductivity of the soil is 0·4 cm/hr, find the total infiltration taking place in 30 min using Phillip's Equation. The soil tube was placed upright with its upper surface saturated. *8*

3. (a) Explain "Potential Evapotranspiration" and "Reference Crop Evapotranspiration". Briefly discuss a procedure to estimate the crop evapotranspiration. *6*

(b) A stream of 135 *l*/sec was diverted from an irrigation canal and 100 *l*/sec discharge was delivered to a field. An area of 1·6 hectare was irrigated in 8 hrs with this water. The effective root zone depth for irrigation was 1·8 m. The runoff loss in the field was 432 m^3. The depth of penetration of water varied linearly from 1·8 m at the head of the field to 1·2 m at the tail end. Available moisture holding capacity of the soil is 20 cm/m depth of soil. Determine the water conveyance efficiency, water application efficiency, water storage efficiency and water distribution efficiency. Irrigation was started at a moisture level of 50% of the available moisture. *8*

4. (a) Discuss various water distribution patterns for allocation and supply of water in canal command areas. *6*

(b) The following data was obtained from a wheat field at various root zone depths prior to applying irrigation water :

Depth for sample (cm)	Weight of wet soil sample (gm)	Weight of dry soil sample (gm)
25 – 50	136·28	127·95
50 – 75	122·95	115·32
75 – 100	110·92	102·64

The bulk density of the soil is 1·5 g/cm^3. The available moisture holding capacity of the soil is 17·8 cm/m depth. Calculate the moisture contents at different depths. *8*

5. (a) Explain the meaning of "drainage coefficient". Discuss the design procedure of surface drains briefly. *6*

(b) Write the assumptions of Elliptical equation for steady state condition and derive the equation for estimation of drain spacing. *8*

6. In an agricultural area, the cross-section has an impermeable stratum at about 6 m below the ground surface. The average hydraulic conductivity of the soil above this was (K) found to be 1·6 m/day. The drainable porosity was estimated as 0·04 m^3/m^3. The horizontal subsurface drains were installed at the spacing of 60 m at a depth of 1·25 m below the ground surface. The depth of water table after complete charging is 0·3 m below the ground surface. Analyse the case of reclamation process and estimate the time required to lower the water table at 0·5 m from the original height after the recharge stops. Use the Non-steady-state drainage formula given below :

$$L = \left[\left\{10\left(\frac{k}{f_d}\right)a_e t\right\}\left\{\frac{1}{ln(h_{mo}(2a_e + h_{mt})) - ln(h_{mt}(2a_e + h_{mo}))}\right\}\right]^{0.5}$$

where various terms have their usual meanings. *14*

7. (a) Explain various design aspects of the centrifugal pumps with the help of a neat sketch. *6*

(b) It is required to calculate the effective head and power of a drive motor for a centrifugal pump to deliver a discharge of 100 *l*/sec. from a sump to an overhead tank. Use the following data :

Difference of water level in the sump and overhead tank = 24·8 m, Suction = 2·8 m, Delivery = 22·0 m, Head loss in suction = 1·06 m, Head loss in delivery = 5·41 m, Diameter of suction and delivery pipe = 250 mm. *8*

8. Write short notes on any ***two*** of the following topics : *2×7=14*

(a) Turbine pumps

(b) Least square method of land grading design

(c) Interceptor drains