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B.Tech Even Semester (CBCS) Exam., May—2019

AGRICULTURAL ENGINEERING

(6th Semester)

Course No. : AECC-30

(Irrigation and Drainage Engineering)

Full Marks : 50Pass Marks : 15

Time : 2 hours

Note : 1. Attempt *any five* questions.

2. Begin each answer in a new page.

3. Answer parts of a question at a place.

4. Assume reasonable data wherever required.

5. The figures in the margin indicate full marks for the questions.

1. Write short notes on the following : 10

(a) Irrigation efficiencies

(b) Soil water potential

(c) Cavitation and priming of pump

(d) NPSH

(e) Pump performance curve

2. (a) What are the considerations during planning of irrigation systems? 3

(b) Define leaching requirement of soil. Give the mathematical expression for leaching requirement. A soil has a field capacity of 25%, permanent wilting point of 11% and apparent specific gravity of 1.6. Irrigation is applied after depletion of 40% of the available moisture to a crop with the root zone depth 600 mm, electrical conductivity of the saturation extract of the soil is 10 mmho/cm and that of the irrigation water is 2.5 mmho/cm. Determine the leaching requirement and the total depth of irrigation. 7

3. (a) A volute centrifugal pump installed in a deep well is driven by a diesel engine, using a two-stage belt drive. The pump discharge is 20 l/s, the suction pipe is 10 cm in diameter and 7 m long. The pumping water level is 5.8 m below the centre line of the pump. The suction pipe is connected to the pump by a long sweep bend of 10 cm in diameter. A 10 cm diameter foot valve is fixed at the intake of the suction pipe. The static discharge head is 12 m, the discharge

pipe is 8 cm in diameter and 16 m long. Three long sweep bends and a reflux valve, each of 8 cm diameters are fixed on the discharge line. The pump discharge into a pressure tank, the pressure inside which is 0.6 kg/cm².

Determine—

- (i) total head;
- (ii) BHP of engine, if the pump efficiency is 74% and drive efficiency 80%.

If the specific fuel consumption of the diesel engine is 0.23 l/kWh, what will be the monthly requirement of diesel to run the engine, if the pump works for 10 hours each day? 6

- (b) Write the centrifugal pumps classification. Express the relationships between pump speed and impeller diameter in the performance of centrifugal pump. 4

4. Differentiate between the following : 10

- (a) Drip and Sprinkler irrigation system
- (b) Water meter and Venturi meter
- (c) Border and Basin irrigation method
- (d) Open drainage and Close drainage

5. (a) For a wheat field, the following information is available :

Field capacity = 41% by volume

Wilting point = 19% by volume

Effective root zone depth = 35 cm

Irrigation is given up to field capacity considering the above root zone

Average daily ET rate for that period = 6 mm/day

Determine—

(i) maximum plant available water within the root zone;

(ii) the time of irrigation (days from the moisture reading) allowing 70% depletion of plant available moisture;

(iii) depth of irrigation required. 5

(b) Write short notes on the following : 5

(i) Maximum plant available soil moisture

(ii) Total maximum available soil moisture

(iii) Total present available soil moisture

(iv) Depletion of available soil moisture

(5)

6. Write short notes (along with the equation for flow measurement) on the following : 10
- (a) Area-velocity method of flow measurement
 - (b) Parshall flume
 - (c) V-notch
 - (d) Portable weir
 - (e) Orifice
7. (a) Write the arrangements of surface and subsurface drain system in field. Also define the drainage coefficient and drainage area. 5
- (b) The EC of canal water used for irrigating wheat is 1.2 mmhos/cm while the can tolerate a maximum EC of 6 mmhos/cm. The ET of wheat is 0.8 cm/day and soil hydraulic conductivity is 0.9 cm/h. The area is to be drained by the tile drains laid at a depth of 2.5 m below ground level so as to maintain water table depth at 1.5 m. The impervious layer is located at a depth of 4 m below the ground surface.
- (i) Compute the drain spacing using Hooghoudt's equation.

(6)

- (ii) Calculate the drainage flow rate out of a 400 ha field.
- (iii) What is the size of drain pipe laid on a gradient of 0.001 m/m, assuming that drain is running full and manning's is 0.01? 5
8. (a) Write the principal factors influencing the amount of infiltration rate in soil. 5
- (b) A field soil has four distinct soil layers within 1.4 m depth from the surface. The depth and vertical hydraulic conductivity of the layers are 0.3, 0.4, 0.3 and 0.4 m; and 1.0, 0.5, 0.7, 0.6 $m^3 / m^2 / d$, respectively. A constant water supply of 0.88 m/d is provided at the soil surface. What will be the resultant hydraulic conductivity of the soil column through the bottom of the soil layer? 5
