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ET-533(A)

B.Tech. Civil (Water Resources Engineering)

Term-End Examination

00705 **December, 2014**

ET-533(A) : IRRIGATION ENGINEERING

Time : 3 hours *Maximum Marks : 70*

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

1. (a) Describe the sprinkler irrigation method and its various components with the help of a neat sketch. Discuss its merits and demerits in comparison to other irrigation methods. *6*

(b) A wet soil sample of 1875 gm was moulded into 1000 cm^3. The soil was dried in an oven for 24 hours at 105°C and it reached a constant mass of 1675 gm. If the specific gravity of the soil is 2·67, compute the following : *8*

(i) Water content of the sample by weight

(ii) Dry unit weight of soil

(iii) Porosity

(iv) Void ratio

2. (a) Explain the term "Irrigation scheduling". Discuss a method to estimate the water requirement of a crop. *6*

(b) In an agricultural field, the double ring infiltrometer test provided the following results :

t = 60 minutes F = 3·8 cm

t = 180 minutes F = 7·8 cm

Evaluate the coefficients in Kostiakov equation. What would be the infiltration rate and the cumulative volume at the end of five hours ? *8*

3. (a) Derive the Richards' equation for one dimensional flow in an unsaturated medium for unsteady flow. *6*

(b) What do you understand by 'Evapotranspiration' ? Draw a neat sketch showing variation of crop coefficient (K_c) with percentage growth of a plant and discuss it briefly. *8*

4. (a) Enlist the names of various on-farm water measuring devices to regulate the water supply. Explain any one of these with the help of a neat sketch and related formula, if any. *6*

(b) The cross-section of a surface drainage channel has a bed width of 1·75 m, side slope of 1 : 1 and a depth of flow 2 m. For the drainage coefficient of 12·5 mm/day/ha, compute the area that can be safely drained by this channel at the bed slope of 1 in 4000. Use Manning's equation with n = 0·22. *8*

5. (a) What are the ill-effects of waterlogging on agriculture ? Discuss various types of drainage systems which may be provided to take care of waterlogging. *6*

(b) What do you understand by leaching requirement of soil ? How does it help to maintain the salt balance in the waterlogged areas ? Explain briefly. *8*

6. (a) Discuss the need of land grading in agricultural fields. Briefly explain various steps of land grading design. *6*

(b) A subsurface drainage system is to be designed for an irrigated agricultural area. The root zone depth for the crop, proposed to be grown during the reclamation process, is 1·2 m. The depth of impervious strata was found at 9 m below the ground surface. The average hydraulic conductivity of the soil is 3 m/day. It is also estimated that 25 mm water depth is percolated below the root zone from the irrigation. If the irrigation is applied after every 14 days, estimate the drain spacing using steady-state equation. *8*

7. (a) Design the contour bench cross-section for the following condition. The average cross slope of the natural ground at the terrace is 4%. The width of the cultivable part should be a multiple of 2·5 m. The bund side slope may be 1V : 2H and its top width is 0·6 m. The maximum depth of any single irrigation is 120 mm and the design storm depth may be taken as 175 mm. *6*

(b) Provide a classification of Rotodynamic pumps and explain the working principles of the centrifugal pumps. *8*

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

(a) Hydraulic conductivity in unsaturated soils

(b) Methods of cut-fill estimation while land grading

(c) Vertical turbine pumps