B.Tech Odd Semester (CBCS) Exam., December—2017

AGRICULTURAL ENGINEERING

(7th Semester)

Course No. : AE–705 (C)

(Land and Water Resource Management)

Full Marks : 75
Pass Marks : 30

Time : 3 hours

The figures in the margin indicate full marks for the questions

Note : 1. Attempt **five** questions, selecting **one** from each Unit.
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.

UNIT—1

1. *(a)* Define 'land use classification'. Explain the difference between 'soil' and 'land'. 3+4=7

(b) Explain the terms 'agro-ecological regions (AERs)' and 'agro-ecological sub-regions' (AESRs). 4+4=8

2. *(a)* What do you understand by grouping of land? What are the treatments and management practices adopted in grouping of land? 3+4=7

(b) List and explain the factors affecting the capability of land. 8

UNIT—2

3. *(a)* With the help of a sketch, derive the expression for steady radial flow discharge of fully penetrating well of an unconfined aquifer. 7

(b) Estimate the average drawdown over an area where 25 million m^3 of water has been pumped through a number of uniformly distributed wells. The area is 150 km^2 and the specific yield of the unconfined aquifer is 25 percent. 4

(c) Determine the volume of water released by lowering the piezometric surface of a confined aquifer by 5 m over an area of A 1 km^2. The aquifer is 35 m thick and has a storage coefficient of 8 3 10 ^{3}. 4

4. *(a)* List the assumptions of Dupuit's equations. 5

(b) How much water can be produced by lowering the water table of an unconfined aquifer 7 m over an area of 2 km^2? The aquifer's porosity and specific retention are 0·38 and 0·15, respectively. 5

(c) An unconfined aquifer consists of three horizontal layers, each individually isotropic. The top layer has a thickness of 10 m and a hydraulic conductivity of 11·6 m/day. The middle layer has a thickness of 4·4 m and a hydraulic conductivity of 4·5 m/day. The bottom layer has a thickness of 6·2 m and a hydraulic conductivity of 2·2 m/day. Compute the equivalent horizontal and vertical hydraulic conductivities. 5

UNIT—3

5. *(a)* With the help of a sketch, explain how the recuperation test is carried out for an open well. 7

(b) A 1 m diameter well penetrates vertically through a confined aquifer 30 m thick. When the well is pumped at 113 m^3/hr,

the drawdown in a well 15 m away is 1·8 m; in another well 50 m away, it is 0·5 m. What is the approximate head in the pumped well for steady-state conditions and what is the approximate drawdown in the well? Also compute the transmissivity of the aquifer and the radius of influence of the pumping well. Take the initial piezometric level as 40 m above the datum. 8

6. *(a)* With the help of a sketch, describe the jet drilling method of well construction. 7

(b) A confined aquifer with a horizontal bed has a varying thickness as shown in Fig. 1. Assuming the flow in the aquifer is essentially horizontal, determine the flow rate if the piezometric heads at sections (1) and (2) are 23·7 m and 27·1 m, respectively. 8

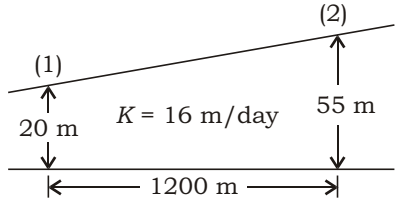

Fig. 1

UNIT—4

7. *(a)* List the methods employed to control seepage through an embankment. 7

(b) Calculate the seepage through an earth dam shown in Fig. 2 resting on an impervious foundation. The relevant data are as follows : 8

Height of the dam = 60·0 m
Upstream slope = 2·75 : 1 (H : V)
Downstream slope = 2·50 : 1 (H : V)
Freeboard = 2·5 m
Crest width = 8·0 m
Length of drainage blanket = 120·0 m
Coefficient of permiability of the embankment material
in x-direction = 4 10^{7} m/s
in y-direction = 1 10^{7} m/s

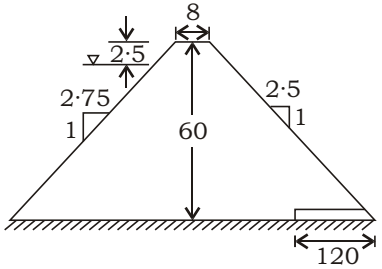

Fig. 2

8. *(a)* What are the advantages and disadvantages of a small earthen embankment dam? 7

(b) Refer to the earth dam cross-section as shown in Fig. 3 measuring 100 m 70 m, calculate the drop in water level in one day. Given that 45 , 30 , B 3 m, H 7 m, height of dam 8·5 m and k 7 10^{3} m/min.frt. 8

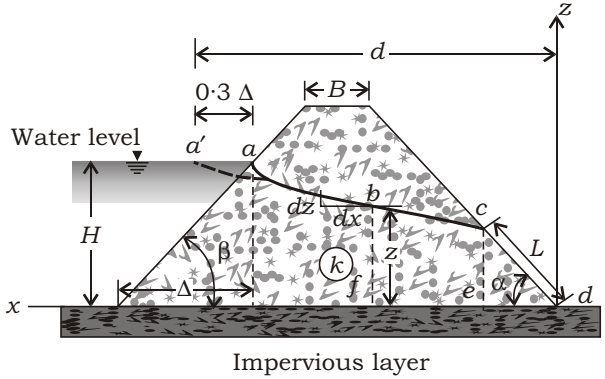

Fig. 3

UNIT—5

9. *(a)* Explain how leaching is used to remove salts from agricultural soil. Define the term leaching requirement. 7

(b) What is activity? Under what conditions does it deviate from the magnitude of molar concentration? What causes it to deviate? 8

10. *(a)* List the steps used for treating sodic and saline-sodic soils. 8

(b) Analysis of 10 gm soil sample showed that the total concentration of exchangeable cations was 2·50 meq and that of exchangeable sodium was 0·8 meq. Express the cation exchange capacity in meq/100 gm soil and exchangeable sodium in percent. 7

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