B.Tech Odd Semester (CBCS) Exam., December—2016

AGRICULTURAL ENGINEERING

(7th Semester)

Course No. : AE–705

(Land and Water Resource Development)

Full Marks : 75
Pass Marks : 30

Time : 3 hours

Note : 1. Answer **one** question 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—I

1. *(a)* What is performance indicator? Name the indicators under engineering, field water use, crop and water productivity, and socioeconomic category. 3+4=7

(b) What are the factors influencing land grading and development? 8

2. *(a)* Write down the principles and procedures of performance evaluation. 7

(b) What do you mean by land grading and land improvement? What is precision grading? 4+4=8

UNIT—II

3. *(a)* Write short notes on the following : 6

(i) Perched aquifer

(ii) Storage coefficient

(iii) Transmissivity

(b) A well with a radius of 0·5 m completely penetrates an unconfined aquifer with K 32 m/day and the height of water table above the bottom of the aquifer being 45 m. The well is pumped so that the water level in the well remains 35 m above the bottom of the well. Assuming that pumping has essentially no effect on the water table at a distance of 300 m from the well, determine the steady-state well discharge. 9

4. *(a)* What is the nature of groundwater flow? State the law governing the flow with limitations, if any. 2+3=5

(b) A fully penetrating artesian well is pumped at a rate of 1500 m^3/day from an aquifer whose S and T values are 4 10 ^{4} and 0 145 m^2/min, respectively. Find the drawdowns at a distance 3 m from the production well after one hour of pumping and at a distance of 350 m after one day of pumping. 10

UNIT—III

5. *(a)* What are the benefits of well development? Describe any one method of well development. 3+4=7

(b) Two tubewells of 150 mm diameter are spaced at 100 m distance and penetrate fully a confined aquifer of 15 m thickness. What will be the percentage decrease in the discharge of each of these wells as a result of pumping both wells simultaneously with a depression head (i.e., drawdown) of 5 m in either case? Assume permeability of the aquifer as 40 m/day and the radius of influence as 300 m. 8

6. A well of size 7·70 m 4·65 m and depth 6·15 m in lateritic soil has its normal water level 5·08 m below ground level (bgl). By pumping for 1½ hours, the water level was depressed to 5·93 m bgl and the pumping was stopped. The recuperation rates of the well during 4 hours after the pumping stopped are given below. The total volume of water pumped during 1½ hours of pumping was 32·22 m^3. (No well staining is provided) :

Recuperation rates	
Time since pumping stopped (min)	*Water level bgl* (m)
0	5·930
15	5·890
30	5·875
45	5·855
60	5·840
90	5·820
120	5·780
180	5·715
240	5·680

Determine—

(a) the rate of seepage into the well during pumping;

(b) the specific yield of the soil and specific capacity of the well;

(c) the yield of the well under a safe working depression head of 0·85 m;

(d) the area of crop that can be irrigated under the well (assume a peak consumptive use of 4 mm and irrigation efficiency of 75%);

(e) the diameter of the well in such a soil to get an yield of 3000 lph under a safe working depression head of 0·8 m. 15

UNIT—IV

7. The available flow for 97% of the time (i.e., in a year) in a river is 30 cumec. A run-of-river plant is proposed on this river to operate for 6 days in a week round the clock. The plant supplies power to a variable load whose variation is given below :

Period (hr)	0–6	6–12	12–18	18–24
$\frac{\textit{Load during period}}{24\text{ hr }\textit{average load}}$ *ratio*	0·6	1·4	1·5	0·5

The other relevant data are given below :

Head at full pond level = 16 m
Maximum allowable fluctuation of pond level = 1 m
Plant efficiency = 80%

Pondage to cover inflow fluctuations = 20% of average daily flow
Pondage to cover wastage and spillage = 10%

Determine—

(a) the average load that can be developed;

(b) daily load factor;

(c) plant capacity;

(d) weekly energy output;

(e) pondage required and the surface area of the pond for satisfactory operation. 15

8. *(a)* Explain the following terms : 8

(i) Saltation

(ii) Suspended load

(iii) Bed load

(iv) Contact load

(b) Describe the common forces acting on a gravity dam. What are the main causes of failure of a gravity dam? 3+4=7

UNIT—V

9. *(a)* Explain the effects of salts on plant growth. List the reasons for salt buildup in agricultural field. 4+5=9

(b) A quantity of 100 ml of gypsum solution, having 30 meq/l concentration as calcium, on reacting with 5 gm of an alkali soil showed 27·5 meq/l of Ca + Mg concentration in the filtrate. Estimate the gypsum requirement in meq/100 gm soil. 6

10. *(a)* List the steps used for treating sodic and saline-sodic soils. 4+4=8

(b) Analysis of 10 gm soil sample showed that the total concentration of exchangeable cation 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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