[Total No. of Questions - 9] [Total No. of Printed Pages - 4]

Dec.-23-0488

CE-604 (Hydrology and Water Resource Engineering)

B.Tech. 6th (CBCS)

Time : 3 Hours **Max. Marks : 60**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions in all, select one question each from sections A, B, C and D. Section E is compulsory.

SECTION - A

1. (a) What is a hydrological cycle? Explain with a neat sketch explaining various phases. State and explain Water budget equation. (5)

   (b) Discuss the impact of climate change on the hydrological cycle. Which sector will be most affected, if the climate change impacts on hydrological cycle are huge, and how? (5)

2. (a) Explain the different methods of determining the average rainfall over a catchment due to a storm. Discuss relative merits and demerits of various methods. (5)

   (b) Discuss the importance of evaporation control of reservoirs and possible methods of achieving the same. (5)

SECTION - B

3. For a given basin, the following are the infiltration capacity rates at various time intervals after the beginning of the storm. Make a plot of the f-curve and establish an equation of the form developed by Horton. Also determine the total rain and the excess rain (runoff).

Time (min)	1	2	3	4	5	6	8	10	12	14	16	18	20	22	24	26	28	30
Precipitation rate (cm/hr)	5	5	5	5	5	7.5	7.5	7.5	7.5	7.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Infiltration rate(cm/hr)	3.9	3.4	3.1	2.7	2.5	2.3	2.0	1.8	1.54	1.43	1.36	1.31	1.28	1.25	1.23	1.22	1.2	1.2

(10)

4. The following are ordinates of 12-hour unit hydrograph. Determine the ordinates of corresponding S-curve hydrograph and using this determine the ordinates of a 4-h unit hydrograph.

Time (Hours)	0	4	8	12	16	20	24	28	32	36	40	44	48
Ordinates of 12-h UH (m^3/s)	0	13.3	43.3	76.7	106.7	103.3	93.3	66.7	50	30	13.3	3.3	0

(10)

SECTION - C

5. (a) List and elucidate the different types of investigations carried out while selecting the site for a reservoir. (5)

   (b) Sketch and explain different zones of storage in a reservoir. How would you determine the reservoir capacity? How does sedimentation affect the reservoir capacity. (5)

6. (a) Define the term "Design flood". Discuss different methods of flood estimation in detail. Also discuss the merits and demerits of different Hood estimation methods. (5)

   (b) What is flood routing? Explain different methods of hydrologic reservoir routing. What are the major points of concern while carrying out reservoir routing? (5)

SECTION - D

7. (a) What is the difference between confined and unconfined aquifers? Explain the law which governs the flow through porous media. (5)

   (b) List and explain the aquifer parameters which influence the discharge from the aquifer. (5)

8. (a) Derive a formula for discharge of a well in a homogeneous artesian aquifer assuming equilibrium flow conditions. (5)

   (b) Distinguish between non-equilibrium and equilibrium conditions in an aquifer from which water is withdrawn through a well. Explain when the above conditions are expected in an aquifer? (5)

SECTION - E (Compulsory)

9. Tick the correct option:

1. The rain gauge station X was inoperative for a part of a month during which a storm occurred. The storm rainfall recorded at the three surrounding stations A, B and C was 75 mm, 59mm and 86 mm respectively. If the normal annual rainfalls of stations A, B, C and X are 750, 650, 850 and 700 mm respectively, determine the storm rainfall of station X.

(a) 68.1 mm (b) 76.5 mm
(c) 62.9 mm (d) 79.1 mm

2. Assuming the initial infiltration rate of 10 mm/hr, final infiltration rate of 5 mm/hr and constant value (describing the rate of decay of the difference between the initial and final infiltration rates) as 0.95 h-1, calculate the total infiltration for a storm lasting 6 hours

(a) 25.83 mm (b) 56.43 mm
(c) 35.25 mm (d) 18.28 mm

3. The Thiessen weights of four raingauges A, B, C and D covering a river basin are 0.15, 0.25, 0.30 and 0.30 respectively. If the average depth of rainfall for basin is 5 cm, and the rainfalls recorded at B, C and D are 5 cm, 4 cm and 5 cm respectively. What is the rainfall at A?

(a) 5 cm (b) 6 cm
(c) 7 cm (d) 8 cm

4. The wind velocity at a height of 2 m above the ground is 15 km/h. What would be the velocity at a height of 10 m above the ground?

(a) 19 km/h (b) 75 km/h
(c) 3 km/h (d) 50 km/h

5. A 4-h storm had 4 cm of rainfall and the resulting runoff was 2 cm. If the ϕ-index is maintained at the same rate, the runoff due to 10 cm of rainfall in 6 hours in the catchment is

(a) 5.0 cm (b) 7 cm
(c) 6 cm (d) 3 cm

6. The 6-hour unit hydrograph on a basin can be approximated as a triangle with a base period of 40 hours and peak ordinate of 150 m^3/s. Then the area of basin is

(a) 2160 km^2 (b) 1080 km^2
(c) 540 km^2 (d) 1280 km^2

7. The peak of a flood hydrograph due to a 6-h storm is 470 m^3/s. The mean depth of rainfall is 8 cm. Assume an average infiltration loss of 0.25 cm/hour and a constant base flow of 15 m^3/s, estimate the peak discharge of a 6-h unit hydrograph for this catchment

(a) 75 m^3/s (b) 82 m^3/s
(c) 70 m^3/s (d) 65 m^3/s

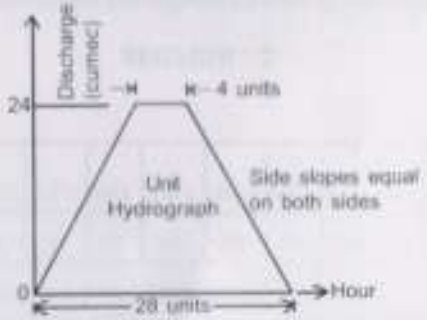
8. The lag time of the basin is the time interval between the

(a) Centroid of RE diagram and peak of the hydrograph.
(b) Beginning and end of direct runoff.
(c) Beginning and end of effective rainfall.
(d) Centroid of rainfall excess and centroid of mass of hydrograph.

9. The peak discharges in 4 and 8 hour unit hydrographs of a basin occur at t_1 and t_2. Then

(a) $t_1 = t_2$ (b) $t_1 > t_2$
(c) $t_1 < t_2$ (d) difficult to guess

10. A 2-hour unit hydrograph can be approximated as trapezoidal as shown in figure. The unit hydrograph refers to catchment of area



(a) 138.24 km^2 (b) 0.0384 km^2
(c) 384 m^2 (d) 3840 m^2 (10×2=20)