

B.E. Fifth Semester (Civil Engineering) (C.B.S.)
Hydrology & Water Resources (HWR)

P. Pages : 4

Time : Three Hours



NKT/KS/17/7322

Max. Marks : 80

- Notes :
1. All questions carry marks as indicated.
 2. Solve Question 1 OR Questions No. 2.
 3. Solve Question 3 OR Questions No. 4.
 4. Solve Question 5 OR Questions No. 6.
 5. Solve Question 7 OR Questions No. 8.
 6. Solve Question 9 OR Questions No. 10.
 7. Solve Question 11 OR Questions No. 12.
 8. Due credit will be given to neatness and adequate dimensions.
 9. Assume suitable data whenever necessary.
 10. Illustrate your answers whenever necessary with the help of neat sketches.
 11. Use of non programmable calculator is permitted.

1. a) Define 'Hydrological cycle' with neat sketch. Explain it's various components in details. **6**
- b) The isohyets due to storm in a catchment & the area of the catchment bounded by isohyets were tabulated as below : **7**

Isohyets (cm)	Area (km ²)
Station – 12.0	30
12.0 to 10	140
10.0 - 8.0	80
8.0 - 6.0	180
6.0 - 4.0	20

Determine the average precipitation in the catchment.

OR

2. a) A catchment has six rain gauge stations. In a year, the annual rainfall recorded by the gauge are as follows- **7**

Station	A	B	C	D	E	F
Rainfall (cm)	82.6	102.9	180.3	110.3	98.8	136.7

- a) Determine the standard error in the estimation of mean rainfall in the existing set of rain gauges.
- b) For a 10% error in the estimation of the mean rainfall, calculate the optimum number of rain gauge stations in the catchment.
- b) Write note on **any two**. **6**
- 1) Use of Radar for measurement of precipitation.
 - 2) Weighing bucket type rain gauge.

3) Types of precipitation.

3. a) The mass curve of rainfall of duration 180 minute on a catchment is given below. The catchment had an initial loss of 0.5 cm. The ϕ index of the catchment is known to be 0.4 cm/hour. Calculate the total surface runoff from the catchment due to this storm. 7

Time from start (min)	0	30	60	80	100	120	150	180
Cumulative rainfall (cm)	0	0.6	1.3	2.6	2.8	3.0	3.2	3.3

- b) What is 'Evapotranspiration'? Describe the factors affecting evapotranspiration process. 6

OR

4. a) Explain the various pans used for the measurement of evaporation. Explain the 'floating pan' with neat sketch. 6

- b) Explain infiltration indices. Also write a note on Horton's infiltration equation. 7

5. a) For a catchment in Haryana, India, the mean monthly temperature are given. Estimate the annual runoff & annual runoff coefficient by Khosla's method. 7

Month	Jan	Feb	Mar	Apr	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Temp °C	12	16	21	27	31	34	31	29	28	29	19	14
Rainfall (P _m) (cm)	4	4	2	0	2	12	32	29	16	2	1	2

- b) Derive the S - Curve for a 4 - h unit hydrograph given below - & Derive the ordinates of 12 - h unit hydrograph for the same catchment. 7

Time (h)	0	4	8	12	16	20	24	28	32	36	40	44
ordinates of 4 - h UH	0	20	80	130	150	130	90	52	27	15	5	0

OR

6. a) What is runoff? State & Explain the various components of runoff with neat sketch. 6

- b) The ordinates of a 6 - h unit hydrograph are given below : 8

Time (h)	0	3	6	9	12	18	24	30	36	42	48	54	60	66
6 - h UH ordinate (m ² /s)	0	150	250	450	600	800	700	600	450	320	200	100	50	0

A storm had three successive 6 - h interval at rainfall magnitude of 3.0, 5.0 & 4.0 cm. respectively. Assuming ϕ index of 0.2 cm/h & base flow of 30m³/s, determine hydrograph of flow.

7. a) For a river, the estimated flood peaks for two return periods by the use of Gumbel's method are as follows -

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Return period (years)	Peak flood (m^3/s)
100	435
50	395

What flood discharge in this river will have return period of 1000 years?

- b) Explain in brief : **any two.**

6

- 1) Risk of the project.
- 2) Return Period.
- 3) Reliability of the project.

OR

8. a) Define 'flood' & what are the limitations of flood frequency studies.

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- b) The mean annual flood of a river is $600\text{m}^3/\text{s}$ & the standard deviation of the annual flood series is $150\text{m}^3/\text{s}$. What is the probability of a flood of magnitude $1000\text{m}^3/\text{s}$ occurring in the river within next 5 years? Use Gumbel's method & assume the sample size to be very large.

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9. a) Define the following & establish the interrelation between them. **any two.**

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- i) Aquifer & Aquitard
- ii) Water table & piezometric surface
- iii) Unconfined aquifer & leaky aquifer.

- b) The discharge from a fully penetrating well operating under steady state in a confined aquifer of 30 m thickness is 2100 litres/minute. The drawdowns observed at two observation well located at 15 m & 150 m from the well are 3.2 m & 0.28 respectively. Determine the transmissibility & the permeability of the aquifer.

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OR

10. a) Define 'Aquifer'? Explain the behavior of water level in wells in confined aquifers due to changes in the atmospheric pressure.

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- b) During a recuperation test, the water in an open well as depressed by pumping by 2.5 m it recuperated 1.8 m in 80 minutes. Calculate the yield from a well of 4 m diameter under a depression head of 3 m.

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11. a) What is rainwater harvesting? State & Explain the various types of rainwater Harvesting.

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b) Write note on following : **any two.**

- i) Interbasin water transfer.
- ii) Interstate river disputes.
- iii) Ground water Recharge methods.

OR

12. Write notes on the following **any three.**

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- i) Watershed Management.
- ii) Multipurpose reservoir.
- iii) Selection of recharge site.
- iv) Water resources of India.
