B.E. (Civil Engineering) Fifth Semester (C.B.S.)

Hydrology & Water Resources (HWR)

P. Pages : 3 **NIR/KW/18/3407**

Time : Three Hours * 1 9 5 7 * Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
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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) Describe with neat sketch hydrological cycle and various processes involved in it. **6**

b) A catchment area has 7 rain gauge station. In a year, the annual rainfall recorded by gauges are as follows : **8**

Station	P	Q	R	S	T	U	V
Rainfall (cm)	130.0	142.1	118.2	108.5	165.2	102.1	146.9

a) Determine standard error in the estimation of mean rainfall in existing set of rain gauge.
b) For a 5% error in estimation of mean rainfall, calculate the minimum number of additional rain gauge station to be established in catchment.

OR

2. a) What are the various types of rain gauges used for measurement of precipitation? Describe briefly the method practiced in India for measurement of rainfall. **6**

b) The normal annual precipitation of five rain gauge station P, Q, R, S and T are respectively 125, 102, 76, 113 and 137 cm. During a particular storm, the precipitation recorded by station P, Q, R and S are 13.2, 9.2, 6.8 and 10.2 cm respectively. The instrument at station T was inoperative during the storm. Estimate the rain fall at station T during the storm. **8**

3. a) What are the different types of evaporimeters. Explain ISI standard pan evaporimeter in brief. **7**

b) Explain the different methods to reduce evaporation losses. **6**

OR

4. a) What to infiltration and factors affecting in filtration. **6**

b) The mass curve of rain fall of 100 min duration is given below. If the catchment had an initial loss of 0.6 cm and a ϕ_{index} of 0.6 cm/hr, calculate the total surface run off from catchment. **7**

Time of start of Rain fall (min)	0	20	40	60	80	100
Cumulative Rain fall (cm)	0	0.5	1.2	2.6	3.3	3.5

5. a) What is run off? Explain with neat sketch the various components of run off. **6**

b) A six hour unit hydrograph of a watershed is given below. Calculate 18 hrs unit hydrograph using S – curve method. **7**

Time (hrs)	0	6	12	18	24	30	36	42	48
UHO (m^3 / sec)	0	1.8	30.9	85.6	41.8	14.6	5.5	1.8	0

OR

6. a) What is hydrograph and brief the components of hydrograph. **6**

b) Ordinates of 6 hr unit hydrograph are given. If each storm of 6 hr. duration occur in succession having rain fall excess 2.5 cm and 4.5 cm respectively. Compute ordinates of resulting hydrograph. Base flow is $50\,m^3/sec$. **7**

Time (hrs)	0	6	12	18	24	30	36	42	48	54	60	66
UHO (m^3 / sec)	0	25	65	155	125	95	66	55	33	22	11	0

7. a) What are the factor affecting peak flood flow. **6**

b) The data on maximum annual flood indicate the maximum annual flood is greater than or equal to $300\,m^3/sec$ has a return period of 100 year. Find the probability of maximum annual flood of greater than or equal to $300\,m^3/sec$ for **7**

i) Once in 50 successive years.
ii) Twice in 50 successive years.
iii) At least once in 50 successive years.

OR

8. a) What is the procedure to estimate the design flood by using Gumbels distribution. **7**

b) Write short note on importance of statics and probability in hydrology. **6**

9. a) Explain the terms : **6**

i) Confined and Unconfined aquifer.
ii) Specific yield and specific retention.
iii) Water table and piezometric surface.

b) The discharge from a fully penetrating well operating under steady state in a confined aquifer of 30 m thickness is 2100 lit/min. The draw down observed at two observation wells located at 15m and 150 m from the well are 3.2 m and 0.28m respectively. Determine the transmissibility and permeability of aquifer. **8**

OR

10. a) Derive expression for constant withdrawal of water from unconfined aquifer under steady state condition. **7**

b) What is Darcy's law, specify the significance and establish relation between Darcy's velocity and actual velocity. **7**

11. a) What is watershed? State and explain various objectives of watershed management. **7**

b) Write a note on multipurpose project. **6**

OR

12. a) What is rain water harvesting? Where can it be implemented? Can existing structures be used for rain water harvesting, explain how? **7**

b) Describe **any three.** **6**

i) Wind Vane.

ii) Anemometer

iii) Sunshine Recorder

iv) Stevenson's Screen.

v) Different types of thermometers.

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B.E. (Civil Engineering) Fifth Semester (C.B.S.)

Hydrology & Water Resources (HWR)

P. Pages : 2 **NJR/KS/18/4462**

Time : Three Hours * 0 2 0 5 * Max. Marks : 80

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8. Assume suitable data whenever necessary.
9. Diagrams and chemical equations should be given whenever necessary.
10. Illustrate your answers whenever necessary with the help of neat sketches.
11. Use of non programmable calculator is permitted.

1. Describe hydrological cycle. Explain with a neat sketch the various process involved in it. **13**

OR

2. a) Differentiate between orographic precipitation and convective precipitation. **6**

b) Explain in brief the different type & precipitation according to the factors responsible for lifting of an air mass. **7**

3. a) Explain: **6**
i) Infiltration curve ii) W-Index

b) A 6 hour storm produced intensities of 7, 18, 25, 12, 10 and 4mm per hour in successive one hour interval over a basin of $600\,km^2$. The resulting runoff is observed to be 2650 hectare meter. Determine ϕ -index for the basin. **7**

OR

4. a) Explain: **6**
i) Water budget ii) Energy budget

b) What do you mean by Evapo-transpiration? How it will be measured. **7**

5. a) What are the factors affecting the runoff? **6**

b) Explain briefly: **8**
i) Classification of streams
ii) Area-velocity method for stream flow measurement.

OR

6. a) How is base flow separated from the storm hydrograph? **6**

b) Explain: **8**
i) S-curve ii) Unit hydrograph.

7. a) Define: **6**
i) Mean ii) Medium
iii) Mode.

b) What are the frequently used density function used in hydrologic analysis? **7**

OR

8. a) Explain flood routine and flood forecasting. **6**

b) What is the probability that a flood of certain magnitude with a return period of 20 years. **7**
i) May occur in next 12 years?
ii) Occurs twice in 10 successive years?

9. a) Explain in detail the occurrence and distribution of ground water. **6**

b) In an confined aquifer 8m. thick, a 10cm diameter well is pumped at 100 lit/min. Steady draw down observed in two wells located at 10m. and 50m. from the centre of the well are 3m and 0.05m respectively. Compute the transmissibility and the hydraulic conductivity of the aquifer. **7**

OR

10. a) Differentiate between: **7**
i) Confined and unconfined aquifer
ii) Aquifer and aquiclude

b) Explain the water balance of a catchment. **6**

11. a) What is recharging? What are the factors governing selection of recharge sites. **7**

b) Explain with neat sketch recharge through rain water harvesting. **7**

OR

12. Write notes on **any three.** **14**
i) Inter basin transfer ii) Inter state river dispute
iii) Anemometer iv) Wind Vane

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B.E. (Civil Engineering) Fifth Semester (C.B.S.)

Hydrology & Water Resources (HWR)

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8. Assume suitable data whenever necessary.

1. a) Described hydrological cycle. Explain with neat sketch the various process involved in it. **7**

b) Define precipitation. Explain in brief the different types of precipitation. **6**

OR

2. a) The average annual rainfall depth recorded at existing five rain gauge station in a drainage basin are 910, 800, 580, 420 & 360 mm. Determine the optimum no of rain gauge stations in the basin so as to limit the percentage error within 15%. Also determine the additional no of rain gauges required to be install in the existing basin. **7**

b) Explain with neat sketch cyclonic precipitation. **6**

3. a) For a 120 min. storm, following are the rainfall recorded at 20 min. interval : 2.5 cm/hr, 2.5 cm/hr, 1.1. cm/hr, 7.5 cm/hr, 12.5 cm/hr and 5.0 cm/hr. Assuming ϕ index to be 3.2 mm/hr, find out the net runoff, total rainfall and w-index. **6**

b) What are the various factors affecting infiltration ? Discuss the salient features of infiltration capacity curve. **7**

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.	Sept.	Oct.	Nov.	Dec.
Temp in ºC	12	16	21	27	31	34	31	29	28	29	19	14
Rainfall in 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.

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
ordinates of 6-h UH	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 30 m^3/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 : **8**

Return period (years)	Peak flood (m3/s)
100	475
50	375

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

b) Explain in brief : **any two.** **6**

i) Risk of the project.

ii) Return period.

iii) Reliability of the project.

OR

8. a) Define 'flood' & what are the limitations of flood frequency studies. **7**

b) The mean annual flood of a river is 600 m^3/s & the standard deviation of the annual flood series is 150 m^3/s. What are the probability of a flood of magnitude 1000 m^3/s occurring in the river within next 5 years ? Use Gumbel's method & assume the sample size to be very large. **7**

9. a) Define the following & establish the interrelation between them (any two) **6**
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 40 m thickness is 3100 litres / minute. The drawdowns observed at two observation well located at 19 m & 160 m from the well are 3.9 m & 0.38 respectively. Determine the transmissibility & the permeability of the aquifer. **7**

OR

10. a) Define 'Aquifer' ? Explain the behaviour of water level in wells in confined aquifers due to changes in the atmospheric pressure. **6**

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. **7**

11. a) What is rainwater harvesting ? State & explain the various types of rainwater harvesting. **7**

b) Write note on : **6**
i) Interbasin water transfer.

OR

12. Write notes on the following **any three.** **13**

i) Watershed Management.

ii) Multipurpose reservoir.

iii) Selection of recharge site.

iv) Water resources of India.

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B.E. Fifth Semester (Civil Engineering) (C.B.S.)

Hydrology & Water Resources (HWR)

P. Pages : 4 **NKT/KS/17/7322**

Time : Three Hours * 0 0 0 5 * Max. Marks : 80

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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 ^{o}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 $30\,m^3/s$, 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 - **7**

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. **6**

b) The mean annual flood of a river is $600\,m^3/s$ & the standard deviation of the annual flood series is $150\,m^3/s$. What is the probability of a flood of magnitude $1000\,m^3/s$ occurring in the river within next 5 years? Use Gumbel's method & assume the sample size to be very large. **7**

9. a) Define the following & establish the interrelation between them. **any two.** **6**

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. **7**

OR

10. a) Define 'Aquifer'? Explain the behavior of water level in wells in confined aquifers due to changes in the atmospheric pressure. **6**

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. **7**

11. a) What is rainwater harvesting? State & Explain the various types of rainwater Harvesting. **7**

b) Write note on following : **any two.** **7**

i) Interbasin water transfer.

ii) Interstate river disputes.

iii) Ground water Recharge methods.

OR

12. Write notes on the following **any three.** **14**

i) Watershed Management.

ii) Multipurpose reservoir.

iii) Selection of recharge site.

iv) Water resources of India.

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B.E. (Civil Engineering) Semester Fifth (C.B.S.)

Hydrology and Water Resource (HWR)

P. Pages : 3 **KNT/KW/16/7322**

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11. Illustrate your answers whenever necessary with the help of neat sketches.
12. Use of non programmable calculator is permitted.

1. a) Describe hydrology cycle. Explain with a neat sketch the various process involved in it. **8**

b) State the precautions which should be followed while selecting a site for a rain gauge station. **6**

OR

2. a) Explain in brief the different types of precipitation according to the factors responsible for lifting of an air mass. **6**

b) The annual rainfall depths recorded at existing 5 rain gauge stations in a drainage area or. **8**

Station	A	B	C	D	E
Annual rainfall (cm)	88	104	138	78	56

i) What is the percentage accuracy of the existing rain gauge network in estimation of the rainfall over the basin?

ii) If it is desired to estimate the rainfall over the basin with not less than 90% accuracy. Is there a need to install additional rain gauge ? If so, how many ?

3. a) What is infiltration ? What are the various factors which affects infiltration ? **6**

b) Determine the net of run-off, total rainfall and w-index for the following data. **7**

Time of rain fall (min)	Total rainfall (cm/hr)
45	3.0
45	3.5
45	13.0
45	9.0
45	3.0

Index = 4.0 cm/hr.

OR

4. a) Explain the different methods adopted to reduce evaporation from a reservoir. **6**

b) The average water spread area of runoff at a reservoir are given for 12 month The pan co-efficient can be assumed at 0.75 Determine the total Evaporation losses per year in million m^3. **7**

Month	Area in km^2	Evaporation in cm
January	752	11
Feb	710	14
March	686	16
April	672	18
May	658	25
June	684	14
July	694	15
August	722	14
September	735	14
October	750	13
November	780	11
December	780	12

5. a) What is hydrograph ? What are the segments of hydrograph ? **6**

b) The mean monthly temperature over a basin for a 12 month period from June to May are 25.8, 24.4, 23.8, 23.5, 23.5, 23.6, 20.2, 17.1, 16.6, 18.5, 23.3, 27.6 & 28.4ºC resp. The observed rainfall in mm in the corresponding months are 86, 229, 208, 115, 15, 182, 10, 24, 24, 12, 0 & 0. Determine annual runoff for the basin using Khosla's formula. **7**

OR

6. a) Write short notes on. **6**
1) Classification of catchment
2) Limitation of Unit hydrograph theory.

b) The ordinates of a 4 hour unit hydrograph in m^3/s for a basin at 4 hr intervals are 0, 4, 44, 70, 52, 38, 27, 18, 11, 6, 2, 0. **7**

If a rainfall excess with intensity of 2.5 cm/hr for a period of 4-hr followed immediately by another 4-hr storm with an intensity of 1.5 cm/hr occurs on the basin, compute ordinates of resulting hydrograph.

7. a) Write short note on importance of statistics and probability in hydrology. **7**

b) Give the importance of frequency analysis. **6**

OR

8. a) Write the procedure to estimate the design flood by using 'Gumbel's distribution'. **7**

b) A flood of a certain magnitude has a return period of 25 year. **6**

i) What is its probability of exceedance ?

ii) What is the probability that this flood may occurs in the next 12 years ?

9. a) Explain the following terms – **6**

1) Unconfined aquifer
2) Confined aquifer
3) Storage coefficient

b) A pumping test was mode in a medium of sand and gravel to a depth of 12m where a bed of clay was encountered. The normal ground water level was at surface observation holes were located at distances of 4m and 10m from the pumping well. At a discharge of 3.6 lit/sec. From the pumping well, a steady state was attained in 24 hours. The drawdown at 4 m was 1.5m and at 10 m was 0.26m. Compute the coefficient of permeability of the soil. **8**

OR

10. a) Distinguish between. **6**

1) Hydraulic conductivity and Intrinsic permeability.

2) Specific yield and specific retention.

b) A 200mm diameter well penetrator 40m below ground water level. After a long period of pumping at a rate $18 m^3/min$. the drawdowns in the observation wells at 14m and 40m from the pumped well are 1.2m and 0.6m respectively. Determine the transmissibility of the aquifer. Take radius of influence as 320m. **8**

11. a) What is watershed ? State and explain various objectives of watershed management. **5**

b) Explain Interstate river dispute in details. **4**

c) What do you mean by inter basin transfer ? **5**

OR

12. a) Write a short note on "Recharge through Rain water harvesting". **5**

b) Write a short note on water resources of India. **4**

c) Write a note on multipurpose project. **5**

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B.E. (Civil Engineering) Fifth Semester (C.B.S.)

Hydrology & Water Resources (HWR)

P. Pages : 2 **TKN/KS/16/7410**

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1. a) Described hydrological cycle. Explain with neat sketch the various process involved in it. **7**

b) Define precipitation. Explain in brief the different types of precipitation. **6**

OR

2. a) The average annual rainfall depth recorded at existing five rain gauge station in a drainage basin are 900, 810, 550, 400 & 320 mm. Determine the optimum no of rain gauge stations in the basin so as to limit the percentage error within 10%. Also determine the additional no of rain gauges required to be install in the existing basin. **7**

b) Explain with neat sketch cyclonic precipitation. **6**

3. a) For a 120 min. storm, following are the rainfall recorded at 20 min. interval : **6**
2.5 cm/hr, 2.5 cm/hr, 1.1 cm/hr, 7.5 cm/hr, 12.5cm/hr and 5.0 cm/hr.
Assuming ϕ index to be 3.2 mm/hr, find out the net runoff, total rainfall and w-index.

b) What are the various factors affecting infiltration? Discuss the salient features of infiltration capacity curve. **7**

OR

4. a) Explain in brief: **6**
i) ISI standard evaporation pan. ii) Water budget method.

b) Compute the weekly evaporation from a reservoir from the following data recorded during the week: **7**
Average inflow into the reservoir = 32.5 m^3/s.
Average outflow from the reservoir = 40.2 m^3/s.
Rainfall during the week = 73.6 mm.
Average water spread area = 15.8 km^2.
Estimated seepage = 0.25 million m^3 storage at the beginning of the week = 9180 Ha-m
Storage at the end of the week = 8630 Ha-m.

5. a) Discuss the various factors which affect the runoff from a basin. **6**

b) The following are the ordinates of 3 hr. Unit hydrograph. Derive the ordinates of a 6 hr. Unit hydrograph and plot the same: **7**

Time (hr)	0	3	6	9	12	15	18	21	24
3 hr. unit hydrograph ordinates (cumec)	0	1.5	4.5	8.6	12	9.4	4.6	2.3	0.8

OR

6. a) Explain briefly: **6**
i) Classification of streams ii) Components of runoff.

b) What is base flow? Describe two methods to separate base flow from total runoff. **7**

7. a) Write a note on: **7**
i) Flood routing ii) Flood forecasting.

b) A culvert is to be designed for a stream of catchment area 200 Ha. This area has a slope of 1 in 1000 and length of travel for water is 1150 m. Estimate the 25 year flood, if the maximum intensity of rainfall is given by; **7**

$$I = \frac{1000\ T_r^{0.2}}{(t+20)^{0.7}}$$

Where I is in mm/hr, T_r is in years and t is in minutes. Assume runoff coefficient of 0.35.

OR

8. a) Explain briefly **any two.** **6**
i) Linear regression.
ii) Correlation coefficient.
iii) Standard error of estimate.

b) Compute mean, standard deviation and coefficient of variation for the following 20 year annual peak flow in a river in m^3/sec :- **8**
190,155,298,136,137,131,140,124,185,104,91,154,109,269,164,270,142,72,130, and 115.

9. a) Define specific yield and specific retention and show their sum is equal to porosity. **6**

b) Calculate the average yield of a well of 3m diameter from the recuperation test wherein the water level is depressed to the extent of 2.5 m and recuperation rate is 1.5 m in 60 minutes. Average depression head is 3 m. **8**

OR

10. a) In confine aquifer 10 m thick, 12 cm diameter well is pump at constant rate of 80 lpm. The steady state drawdown observed in two wells located at 15 m & 60 m distance from the centre of well have drawdown of 2.5 m & 0.05 m respectively. Compute the transmissibility & hydraulic conductivity of the aquifer. **8**

b) Difference between **6**
i) Aquifer & aquitard
ii) Pumping test & recuperation test.

11. a) Explain in details the methods of groundwater recharge. **7**

b) What is rainwater harvesting? Explain the various types of rainwater harvesting. Methods. **6**

OR

12. Write a short notes of following **any three.** **13**
i) Interstate River dispute.
ii) Multipurpose reservoir project
iii) Water shed management.
iv) Resource planning in project.

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NTK/KW/15–7410

Fifth Semester B. E. (Civil Engg.) (CBS) Examination

HYDROLOGY AND WATER RESOURCES

Time : Three Hours] [Max. Marks : 80

N. B. : (1) All questions carry marks as indicated.
(2) Answer **total Six** questions as per the choices given from **Twelve** questions.
(3) Assume suitable data wherever necessary.
(4) Illustrate your answers wherever necessary with the help of neat sketches.
(5) Use of Non-programmable electronic calculator is permitted.

1. (a) Explain briefly the importance of temperature, humidity and wind in hydrological study. 7

(b) Define the following terms :—

(i) Intensity of rainfall.

(ii) Mass curve.

(iii) Heytograph.

(iv) Raingauge (Recording)

(v) Non-recording raingauge

(vi) Artificial rain. 6

OR

2. (a) Explain briefly orographic precipitation and convective precipitation. 5

(b) Calculate the optimum number of rain gauges for a drainage basin so as to limit the percentage error within 8%. At present the drainage basin is provided with 5 raingagues. The average rainfall in cm at these stations is : 95, 85, 70, 55 and 40. Also determine the standard error of estimation of average rainfall in the existing set of raingauges. 8

3. (a) Draw a typical infiltration curve and indicate on it the various components. If infiltration capacity of a catchment is represented by $f = 0.5 + 1.2e^{-0.5xt}$ determine the values of various components. 6

(b) A 6 hour storm produced rainfall intensities of 7, 18, 25, 12, 10 and 4 mm per hour in successive one hour interval over a basin of 600 km^2. The resulting runoff is observed to be 2650 hecter-meters. Determine ϕ-index for the basin. 7

OR

4. (a) If 7.35 litres of water is removed from an evaporation pan of diameter 1.25m and

simultaneously the rainfall recorded is 9.2 mm, determine the evaporation in mm. 5

(b) Observations recorded for a reservoir during a period of one day are as follows :

(i) Catchment area = 25 km^2

(ii) Waterspread = 0.7 km^2

(iii) Precipitation during the period = 50 mm

(iv) Runoff coefficient for basin = 0.6

(v) Drop in reservoir water level during the period = 10 cm

(vi) Constant discharge from reservoir = 9 m^3/s.

Find the average rate of evaporation during the given period in mm/hr neglecting seepage losses. 8

5. (a) What are the various components of runoff ? Explain in brief. 6

(b) Explain briefly :—

(i) Area-velocity method for stream flow measurement.

(ii) Classification of streams. 8

OR

6. (a) How is base flow separated from the storm hydrography ? 5

(b) Ordinates of 6 hr unit hydrograph are as given below :

Time	0	6	12	18	24	30	36	42	48	54	60	66
6 hr UHO	0	25	65	155	125	95	66	55	33	22	11	00

If two storms each of 6 hr duration occur in succession having rainfall excess 2.5 cm and 4.5 cm resp, compute ordinates of resulting hydrograph assuming base flow 50 cumecs. 9

7. (a) What is the probability that a flood of certain magnitude with a return period of 20 years,

(i) May occur in next 12 years ?

(ii) Occurs twice in 10 successive years ? 6

(b) Explain briefly :—

(i) Causes and effects of flood.

(ii) Risk and reliability. 7

OR

8. (a) Peak flow records for a river at a station, where a reservoir is to be constructed for a period of 80

years is as follows :—

(i) The arithmetic mean of peakes = 7820 m^3/sec

(ii) The standard deviation = 2500 m^3/sec

Using Gumbel's method, determine the recurrence interval for a flood of 15000 m^3/sec. For 80 year sample size, Reduced mean, $\bar{y}_n$ = 0.5569 and reduced standard deviation S_n = 1.1938. 6

(b) A culvert is proposed across a stream draining an area of 180 hectares. The catchment has a slope of 0.004 and length of travel of water is 1150m. Estimate 25 years flood if rainfall intensity is given by,

$$I = \frac{1000\ T_r^{0.2}}{(t+20)^{0.7}}$$

$I \rightarrow$ mm/hr
$T_r \rightarrow$ years
$t \rightarrow$ minutes

Assume runoff coeff. = 0.35 7

9. (a) Define and discuss :—

(i) Porosity.

(ii) Specific retention.

(iii) Aquifer.

(iv) Perched water table. 6

(b) In an confined aquifer 8 m thick, a 10 cm dia. Well

is pumped at 100 lit/min. Steady drawdown observed in two wells located at 10 m and 50 m from the centre of the well are 3m and 0.05 m resp. compute the transmissibility and the hydraulic conductivity of the aquifer. 7

OR

10. (a) The water level in the well was depressed by 3.5 m and it was observed to rise by 1.25 m in 60 minutes, determine.

    (i) Yield from a well of 2.5 m dia, under a depression head of 3.0 m

    (ii) Diameter of a well to yield 7.5 lit/sec under a depression of 2.2 m. 7

    (b) Explain in brief methods of groundwater exploration. 6

11. (a) Explain in brief Groundwater recharge and any two recharging methods. 7

    (b) Explain briefly :—

    (i) Ground water quality.

    (ii) Ground water movement. 7

OR

12. Write short notes on : (Any **Four**) :—

    (i) Inter-basin water transfer.

(ii) Water resource planning through watershed management.

(iii) Multipurpose project.

(iv) Interstate river dispute.

(v) Selection of recharge sites. $3\frac{1}{2} \times 4 = 14$