Dr Vijan Shentan -

119

Department of Civil Engineering National Institute of Technology Hamirpur (HP) Semester Examination

CE – 222

Maximum Marks: 50

Water Resource Engineering – I Time Allowed: Three Hours

Note: 1. Attempt all questions

2. Answers should be brief and specific

Q. No. 1: Explain the hydrological cycle in nature with the help of a neat sketch, indicating its various phases. What is the function of hydrology in water resources development? What are the basic hydrological requirements for a river basin development? (4, 3, 3)

Q. No. 2: For the basin shown in the figure below, the normal annual rainfall depths recorded, and the isohyets are given. The total area of the basin is 7180 Km², where isohyetal/zonal areas for Zone I, II, III, IV, V and VI are 410, 900, 2850, 1750, 720 and 550 Km² respectively. Determine the optimum number of raingauge stations to be established in the basin if it is desired to limit the error in the mean value of rainfall to 8%. Indicate how you are going to distribute the additional rain-gauge stations required, if any. What is the percentage accuracy of the existing network in the estimation of average depth of rainfall over the basin? (4, 4, 2)



Q. No. 3: (a) The average rainfall over 45 ha of watershed for a particular storm was as follows:

Time (Hours)	0	1	2	3	4	5	6	7
Rainfall (cm)	0	0.5	1.0	3.25	2.5	1.5	0.5	0

The volume of runoff from this storm was determined as 2.5 ha-m. Establish the Φ index.

(5)

(b) What are the factors that influence the process of evaporation? Why is it needed to reduce evaporation from the lakes and reservoirs? Briefly enumerate the methods to reduce evaporation. (2, 1, 2)



Q. No. 4: The 3-hr unit hydrograph ordinates for a basin are given below. There was a storm, which commenced on July 15^{th} at 16:00 Hours and continued up to 22:00 Hours, which was followed by another storm on July 16^{th} at 4:00 Hour which lasted up to 7:00 Hour. It was noted from the mass curves of the self-recording raingauge that the amount of rainfall on July 15^{th} was 5.75 cm from 16:00 to 19:00 Hours and 3.75 from 19:00 to 22:00 Hours, and on July 16, 4.45 cm from 4:00 to 7:00 Hour. Assuming an average loss of 0.25 cm/hour and 0.15 cm/hour for two storms, respectively, and a constant base flow of 10 cumec, determine the stream flow hydrograph and state the time of occurrence of peak flood. (10)

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Time (Hours)	0	3	6	9	12	15	18	21	24	27
3-h UH Ordinates (m^{3}/s)	0	1.5	4.5	8.6	12.0	9.4	4.6	2.3	0.8	0

OR

The following are ordinates of 4-hour unit hydrograph for a particular basin. Determine the ordinates of 2-hour unit hydrograph. The area of the basin is 630 Km^2 . (10)

<i>y y y</i>										(10)					
Time (Hours)	0	2	4	6	8	10	12	14	16	18	20	22	24		
Ordinates of 4-h	0	25	100	160	190	170	110	70	30	20	6	1.5	0		
UH (m^3/s)															

Q. No. 5: The following are the ordinates of the 9-hour unit hydrograph for the catchment of river Beas upto Pandoh dam site:

Time (Hours)	0	9	18	27	36	45	54	63	72	81	90
Discharge (m ³ /s)	0	69	1000	210	118	74	46	26	13	4	0

And the catchment characteristics are A = 4480 Km², L = 318 Km, L_{ca} = 198 Km

Derive a 3-hour unit hydrograph for the catchment area of river Beas up to the head of Pandoh Dam reservoir given the catchment characteristics as:

 $A = 3780 \text{ Km}^2$, L = 284 Km, $L_{ca} = 184 \text{ Km}$

Use Snyder's approach with necessary modifications for the shape of the hydrograph. (10)