GAURAV

Q1. Answer the following:

(a) The normal annual precipitation of five raingauge stations P, Q, R, S and T are respectively 125, 102, 76, 113 and 137 cm. During a particular storm, the precipitation recorded by stations 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 that storm. Estimate the rainfall at station T during that storm.

(b) The rainfalls for the successive 30 minute period of a 3-hour storm are: 1.6, 3.6, 5.0, 2.8, 2.2 and 1.0 cm. The corresponding surface runoff is estimated to be 3.6 cm. Determine the Φ – index for this storm (in cm/h).
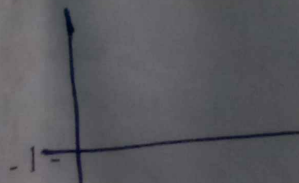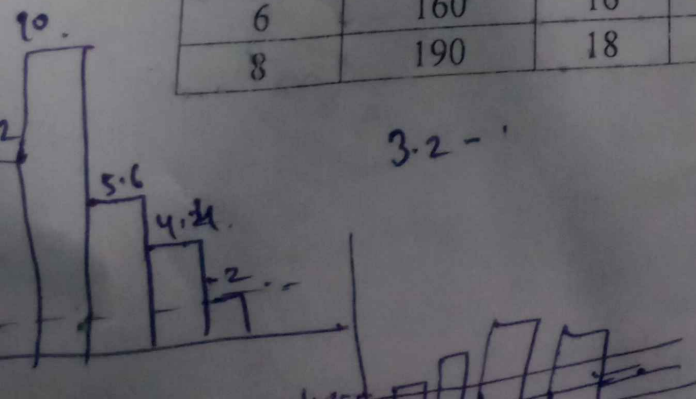
$$\phi = \frac{P-R}{T}$$

$(2 + 5 = 7)$

Q2. Estimate the mean areal rainfall for a circular area of radius 6.0 with its centre at the coordinate (6,6) using the Thiessen polygon method. The observed rainfall (in cm) at five different rain-gauge stations having coordinates (6,6), (6,0), (12,6), (6,12) and (0,6) are 18, 24, 21, 17 and 26, respectively.

(3)

Q3. Following are the 4 hour UH ordinates for a particular catchment of areal extent 630 km². If a rainfall of 5 cm occurs uniformly over the catchment in 2 hours, what will be the flood hydrograph at the outlet of the catchment? Assume Φ-index of 0.5 cm/h and a constant base flow of 30 m³/s for the catchment.

Time (h)	Discharge (m³/s)	Time (h)	Discharge (m³/s)	Time (h)	Discharge (m³/s)
0	0	10	170	20	10
2	15	12	110	22	5
4	95	14	70	24	0
6	160	16	30		
8	190	18	20		

(7)

3.2 - '

$$\phi = \frac{16.2 - 3.6}{3} = 4.2$$

(9cm)

Q4. A storm of 3 cm, 5 cm and 4 cm occurred in three successive 4 hour intervals in a catchment of area 2505.6 km². This resulted in the following storm hydrograph at the outlet of the catchment. Assuming a base flow of 20 m³/s, derive a 4 hour unit hydrograph for the catchment.

Time (h)	Discharge (m³/s)	Time (h)	Discharge (m³/s)	Time (h)	Discharge (m³/s)
0	20	16	4420	32	210
4	380	20	3000	36	50
8	1860	24	1440	40	20
12	3880	28	600		

(8)

Q5. Answer the following questions very briefly:
(i) State the difference between mean and normal rainfall.
(ii) What is the effect of catchment shape on peak runoff?
(iii) In the rational formula, why is the rainfall intensity computed for a duration equal to the time of concentration of the watershed?
(iv) State an important assumption of SCS curve number method.
(v) What is the utility of a rating curve?

$(1 \times 5 = 5)$

$\phi = \left(\dfrac{P-R}{T}\right)$

X

runoff.

$\dfrac{220}{(5\cdot5)}$.

$\phi = \dfrac{\left((11) \times 20. \, m^3 \times 3600\right] 4 \quad \times 1000}{2505\cdot6 \times 1000 \times 1000}$

40

$\phi = (316)$ cm in 4 hour

$(3-\phi) \times 4 + (5-\phi) \times 4 + (4-\phi) \times 4 = 9$

$12 + 20 + 16 - 12\phi = 9$

$48 - 12\phi = 9$

$4\phi + 16 - 4\phi = 9$

$-8\phi = 9$