

INSTRUCTIONS: ATTEMPT ALL THE QUESTIONS.

1. A 12-hour storm rainfall with the following depths in cm occurred over a basin: 2.0, 2.5, 7.6, 3.8, 10.6, 5.0, 7.0, 10.0, 6.4, 3.8, 1.4 and 1.4. The surface runoff resulting from the above storm is equivalent to 25.5 cm of depth over the basin. Determine the average infiltration index (Φ -index) for the basin.

Solution:

$$\Phi\text{-index} = (\text{rainfall} - \text{Runoff}) / \text{duration}$$

$$\text{Total rainfall in 12 hours (p)} = 61.5 \text{ cm}$$

$$\text{Total runoff in 12 hours (R)} = 25.5 \text{ cm}$$

$$\text{Total infiltration in 12 hours} = 61.5 - 25.5 = 36 \text{ cm}$$

$$\text{Average infiltration} = 3.0 \text{ cm/hr}$$

2. The rainfall intensities for the successive 1-hour period for 8-hrs storm is given as 20, 24, 30, 15, 35, 20, 10, 12 mm/hr, if the total runoff is 80mm, determine the value of Φ -index.

Solution:

$$\text{Total rainfall} = 20 + 24 + 30 + 15 + 35 + 20 + 10 + 12 = 166 \text{ mm}$$

$$\text{Total runoff} = 80 \text{ mm}$$

$$\text{Infiltration losses} = \text{Rainfall} - \text{Runoff} = 166 - 80 = 86 \text{ mm}$$

$$\Phi\text{-index} = (86/8) = 10.75 \text{ mm/hr} = 1.075 \text{ cm/hr}$$

3. In a catchment area of 5 km^2 , the intensity of rainfall per hour for a 5hr duration storm are 10, 15, 20, 22, 5 mm. The volume of direct runoff is measured as 0.5 cumec-day. Determine the Φ -index. For the catchment.

Solution:

$$\text{Total rainfall} = 72 \text{ mm}$$

$$\text{Average rate of rainfall (intensity of rainfall)} = (72/5) = 14.4 \text{ mm/hr.}$$

$$\begin{aligned} \text{Total volume of rainfall over the catchment} &= (72 \times 5 \times 10^6) / 1000 \\ &= 360000 \text{ m}^3 \end{aligned}$$

$$\begin{aligned} \text{Total volume of runoff over the catchment} &= 0.5 \times 60 \times 60 \times 24 \\ &= 43200 \text{ m}^3 \end{aligned}$$

$$\begin{aligned} \text{Infiltration losses} = \text{Rainfall} - \text{Runoff} &= 360000 - 43200 \\ &= 316800 \text{ m}^3 \end{aligned}$$

$$\begin{aligned} \text{Depth of water over Catchment} &= (316800 / 5 \times 10^6) \\ &= 0.0633 \text{ m} \end{aligned}$$

$$= 63 \text{ mm}$$

$$\Phi\text{-index} = 63/5$$

$$= 12.6 \text{ mm/hr}$$