Total No. of printed pages = 4

CE 181602

Roll No. of candidate

14/6/23

2023

B.Tech. 6th Semester End-Term Examination

ENGINEERING HYDROLOGY

(New Regulation (w.e.f. 2017-18) &
New Syllabus (w.e.f. 2018-19))

Full Marks – 70   Time – Three hours

The figures in the margin indicate full marks
for the questions.

Answer question No. 1 and any *four* from the rest.

1.   Choose the correct answer for the following multiple choice questions:

$(10 \times 1 = 10)$

(i)   An isohyet is a line joining points of

   (a)   Equal temperature

   (b)   Equal humidity

   (c)   Equal rainfall depth

   (d)   Equal evaporation

(ii)   The double-mass-curve technique is adopted to

   (a)   Estimate the missing data

   (b)   Obtain intensities of rainfall at various durations

   (c)   Check the consistency of rainfall data

   (d)   Obtain the amount of storage needed to maintain a demand pattern

(iii)   If a soil has an infiltration capacity of f_c and rainfall intensity i, then the actual infiltration rate f is given by

   (a) $f = i$, when $i > f_c$

   (b) $f = i$, when $i < f_c$

   (c) $f < f_c$, when $i > f_c$

   (d) $f = f_c$, when $i > f_c$

[Turn over

(iv) Direct runoff is made up of

    (a) Overland flow only

    (b) Surface runoff, infiltration and evaporation

    (c) Surface runoff only

    (d) Surface runoff, prompt interflow and channel precipitation

(v) Identify the chemical suitable for use as a water evaporation inhibitor

    (a) Ethyl alcohol

    (b) Cetyl alcohol

    (c) Butyl alcohol

    (d) Methyl alcohol

(vi) A 6-hr, unit hydrograph (UH) of a catchment is triangular in shape with a total time base of 36 hours and a peak discharge of 18 m³/sec. The area of the catchment (in sq.km) is

    (a) 233

    (b) 116.64

    (c) 1.2

    (d) 324

(vii) The coefficient in Muskingum method of flood routing method will have values such that

    (a) $C_0 + C_1 = C_2$

    (b) $C_0 - C_1 - C_2 = 1$

    (c) $C_0 + C_1 + C_2 = 0$

    (d) $C_0 + C_1 + C_2 = 1$

(viii) A watershed got transformed from rural to urban over a period of time. The effect of urbanization on storm runoff hydrograph from the watershed is to

    (a) Decrease the volume of run off

    (b) Increase the time to peak discharge

    (c) Decrease time base

    (d) Decrease the peak discharge

(ix) The basic assumption of unit hydrograph theory is

    (a) Linear response and time variance

    (b) Linear response and time invariance

    (c) Non-linear response and time invariance

    (d) Non-linear response and time variance

(x) The general equation for hydrological frequency analysis state that, X_T = value of a variate with a return period of T years is given by X_T =

(a) $X' - K\sigma$

(b) $X' + K\sigma$

(c) $X'/K\sigma$

(d) $K\sigma$

(Where X' = Mean of flood data, σ = standard deviation of flood data, K = frequency factor)

2. (a) Explain different types of precipitation. Define hydrologic cycle with its different components. (5+5)

(b) The annual rainfall at 7 rain gauge stations in a basin are 58, 94, 60, 45, 20, 88 and 68 cm respectively. What is the percentage accuracy of the existing network in the estimation of the average depth of rainfall over the basin? How many additional gauges are required if it is desired to limit the error to only 10% (5)

3. (a) Explain Horton's infiltration capacity curve. What are the different infiltration indices? Explain each of them by sketches where necessary. (3+5)

(b) The rainfall depth in where successive 8 hours period are 1.6, 5.4 and 4.1 cm respectively. If the initial loss is 0.6 cm and the surface runoff resulting from this storm is 4.7 cm. What will be the ϕ index for this storm? (7)

4. (a) Define storm or flood hydrograph with its different components. Explain different factors affecting hydrograph. (4+4)

(b) The ordinates of a 2 hour unit hydrograph are given below:

Time(hr.)	0	2	4	6	8	10	12	14	16	18
2hrUHG ordinates(m³/s)	0	13	54	126	112	94	64	36	14	0

Find the ordinates of 4 hour unit hydro graph by S-curve method. (7)

5. (a) What do you mean by evaporation? Discuss the water budget method for measurement of evaporation. (2+5)

(b) Compute the weekly evaporation from reservoir using the water budget method from the following record during the week: (8)

Average inflow into the reservoir = 31.50 m³/s

Average outflow from the reservoir = 40.20 m³/s

Rainfall during the week = 73.6 mm

Surface area of reservoir = 15.8 km²

Estimate seepage = 0.25 million m³

Storage at the beginning of the week = 9180 ha.m

Storage at the end of the week = 8630 ha.m

CE 181602   3   [Turn over

6. (a) What is flood routing? Discuss different methods of flood routing. How does stream flow routing differ from reservoir flood routing? (2+4+4)

(b) The inflow hydrograph for a river reach is given below : (5)

Time (hour)	0	12	24	36	48
Inflow(m³/s)	100	750	780	470	270

Assume that the initial flood for the river reach at the downstream point is 100 m³/s.

Muskingum coefficient (K) = 18 hours, weighing factor (X) = 0.3 , Using a routing period of 12 hours, route this flood to a downstream point of river using Muskingum method of flood routing.

7. (a) What are the different methods of estimation of peak flood? Explain any two of them. (2+6)

(b) An urban area has a runoff co-efficient of 0.3 and an area of 0.85 km² . The maximum depth of rainfall with a 25 year return period is as below : (7)

Duration (min)	5	10	20	30	40	60
Depth of rainfall (mm)	17	26	40	50	57	62

If a culvert for drainage at the outlet of this area is to be designed for a return period of 25 years, estimate the required peak flow rate. Take time of concentration for the drainage area as 30 min.