

Total No. of printed pages = 4

CE 181602

Roll No. of candidate

30/7/22

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2022

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B.Tech. 6th Semester End-Term Examination

ENGINEERING HYDROLOGY

(New Regulation & New Syllabus)

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: (10 × 1 = 10)
- (i) In selecting site for a rain gauge, the nearest object should be at a minimum distance of
- (a) twice its height
 - (b) three times its height
 - (c) equal to its height
 - (d) anywhere
- (ii) Orographic precipitation occurs due to air masses being lifted to higher altitudes by
- (a) The density difference of air masses
 - (b) a frontal action
 - (c) the presence of mountain barriers
 - (d) extratropical cyclones
- (iii) ϕ -index is defined as
- (a) the difference between maximum and minimum infiltration capacity
 - (b) the difference between maximum and minimum runoff
 - (c) rainfall intensity above which rainfall volume equals to runoff volume
 - (d) minimum infiltration rate during the storm

[Turn over

- (iv) The S-curve hydrograph is
- the summation of the unit hydrograph
 - the summation of the total runoff hydrograph
 - the summation of the rainfall hyetograph
 - all the above
- (v) The flow-duration curve is a plot of
- accumulated flow against time
 - discharge against time in chronological order
 - the base flow against the percentage of times the flow is exceeded
 - the discharge against the percentage of times the flow is equalled or exceeded
- (vi) Base-flow separation is performed
- on an unit hydrograph to get the direct-runoff hydrograph
 - on a flood hydrograph to obtain the magnitude of effective rainfall
 - on a flood hydrograph to obtain the rainfall hyetograph
 - on hydrographs of effluent stream only
- (vii) The basic assumptions of the unit-hydrograph theory are
- nonlinear response and time invariance
 - time invariance and linear response
 - linear response and linear time variance
 - nonlinear time invariance and linear response
- (viii) The probable maximum flood is
- the standard project flood of an extremely large river
 - a flood adopted in the design of all kinds of spillways
 - a flood adopted in all hydraulic structures
 - an extremely large but physically possible flood in the region
- (ix) The hydraulic methods of flood routing use
- equation of continuity only
 - equation of motion only
 - both the equation of motion and equation of continuity only
 - energy equation only

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(x) For channel routing, the Muskingum storage equation is given by

(a) $K [xl + (1-x)Q]$

(b) $K [xQ + (1-x)l]$

(c) $K [xQ + (1-x)Q]$

(d) $K [xl + (1+x)Q]$

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2. (a) Explain the different forms of precipitation. How missing annual precipitation at a station is estimated? (8)

(b) What are the common causes of inconsistency in precipitation record? Discuss how consistency of precipitation record can be tested and corrected. (7)

3. (a) Explain how infiltration in field can be measured? What are the different infiltration indices? Explain each of them by sketches where necessary. (8)

(b) The average rainfall over 55 hectares of watershed for a particular storm was as follows:

| | | | | | | | | |
|---------------|---|------|------|------|------|------|------|---|
| Time (hr) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Rainfall (cm) | 0 | 0.75 | 1.25 | 3.40 | 2.95 | 1.40 | 0.80 | 0 |

The volume of runoff from the storm was determined as 3.20 ha-m. Establish the ϕ -index. (7)

4. (a) Define Unit hydrograph and state its limitations. (4)

(b) What is S-curve? Explain its uses. (4)

(c) The ordinate 4-hr unit hydrograph are given as :

| Time (hr) | UHO (m^3/sec) | Time (hr) | UHO (m^3/sec) |
|-----------|-------------------|-----------|-------------------|
| 0 | 0 | 5 | 9.2 |
| 1 | 1.8 | 6 | 5.3 |
| 2 | 4.9 | 7 | 2.8 |
| 3 | 8.8 | 8 | 0.9 |
| 4 | 11.9 | 9 | 0 |

Derive S-curve and obtain 1-hr unit hydrograph. (7)

5. (a) What is runoff? Discuss the factors that affect the runoff. Explain any two methods of separation of base flow from the flood hydrograph. (8)

(b) Explain Synthetic unit hydrograph. A basin has 560 sq.km of area, $L=30km$, $L_{ca} = 18km$. Assuming $C_t = 1.30$, $C_p = 0.70$, develop a 3-hr Synthetic unit hydrograph for the basin using Snyder's method. (7)

6. (a) Explain the different methods of estimation of peak flood. Explain briefly the difference between annual duration series & duration series. (7)
- (b) The observed annual flood peak in m^3/sec of a river for the period 2001 to 2015 are: 3210, 4000, 2250, 1846, 3160, 2842, 1985, 4260, 2194, 3625, 3180, 1826, 3629, 2944 and 4380. Estimate the peak flood of 100 years return period by Gumbel's method. (8)
7. (a) How does 'stream flow routing' differ from 'reservoir flood routing'? Discuss Pul's method of reservoir routing. Also give the stepwise solution of the method. (8)
- (b) Route the following flood through a reach for which $K= 22$ hour and $X=0.25$. Initial outflow = $20 \text{ m}^3/\text{sec}$. (7)

| | | | | | | | | | | | | |
|--------------------------------------|----|----|-----|-----|-----|-----|-----|----|----|----|----|----|
| Time (hr) : | 0 | 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 64 | 60 | 66 |
| Inflow (m^3/sec) : | 20 | 80 | 210 | 240 | 215 | 170 | 130 | 90 | 60 | 40 | 28 | 16 |

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