

[Total No. of Questions - 9] [Total No. of Printed Pages - 4]  
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M. Tech 1st Semester Examination

Advanced Hydrology

WRE-102

Time : 3 Hours

Max. Marks : 100

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions in all, select one question from each sections A, B, C and D. Section E is compulsory.

SECTION - A

1. (a) Define hydrology. Explain various processes involved in hydrologic cycle. (10)  
(b) State Reynolds Transport Theorem. Explain the significance of Reynolds Transport theorem in hydrology. (10)
2. (a) Explain the significance of water budget equation. What are the various applications of water budget equation in hydrology from the engineering point of view? (10)  
(b) What do you understand by hydrologic model? Explain the various types of models. (10)

SECTION - B

3. Explain the factors on which rate of evaporation depends. What are the various processes involved in measurement and estimation of evaporation over the earth surface? Enumerate various methods for the reduction of evaporation over the reservoir. (20)

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4. (a) Explain the significance of infiltration indices. In a 140 min storm the following rates were observed in successive 20 min intervals: 3.0, 3.0, 9.0, 6.6, 1.2, 1.2 and 6.0mm/h. Assuming the  $\phi$ -index as 3.0 mm/h and an initial loss of 0.8 mm, determine the total rainfall, net runoff and W-index for the storm. (10)  
(b) Explain the significance of following terms in hydrology:  
(i) Soil moisture.  
(ii) Porosity.  
(iii) Saturated and unsaturated flow.  
(iv) Pan evaporation. (10)

SECTION - C

5. The ordinates of the IUH of a catchment are given below. Derive the direct runoff hydrograph (DRH) for this catchment due to a storm of duration 4 hours and having rainfall excess of 5cm. (20)

|                                   |   |   |    |    |    |    |    |    |    |    |    |    |    |
|-----------------------------------|---|---|----|----|----|----|----|----|----|----|----|----|----|
| Time (hours)                      | 0 | 1 | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 |
| IUH ordinates (m <sup>3</sup> /s) | 0 | 8 | 35 | 50 | 47 | 40 | 31 | 23 | 15 | 10 | 6  | 3  | 0  |

6. (a) What is a unit hydrograph? List the assumptions involved in the unit hydrograph theory. (10)  
(b) Given the ordinate of a 4-h unit hydrograph as below, derive the ordinate of a 12-h unit hydrograph for the same catchment. (10)

|                    |   |    |    |     |     |     |    |    |    |    |    |    |
|--------------------|---|----|----|-----|-----|-----|----|----|----|----|----|----|
| Time (hours)       | 0 | 4  | 8  | 12  | 16  | 20  | 24 | 28 | 32 | 36 | 40 | 44 |
| Ordinate of 4-h UH | 0 | 20 | 80 | 130 | 150 | 130 | 90 | 52 | 27 | 15 | 5  | 0  |

[P.T.O.]

**SECTION - D**

7. Write short notes on following:

- (i) Chi-square test.
- (ii) Laws of probability.
- (iii) Flood forecasting methods.
- (iv) Log Pearson distribution.
- (v) Design flood for any hydraulic structure. (5×4=20)

8. Discuss in detail, the various method for flood estimation.  
(20)

**SECTION - E**

9. State whether given statements are true or false:

- (i) Interception losses include evaporation, through flow and stream low.
- (ii) Evapotranspiration is confined to daylight hours.
- (iii) In a hydrograph the initial losses and high infiltration losses during the early period of a storm cause the discharge to rise rather slowly in the initial periods.
- (iv) In the unit hydrograph the distribution of the storm is considered to be uniform all over the catchment.
- (v) If precipitation is decidedly non uniform, unit hydrograph yields good result.
- (vi) A unit hydrograph has one unit of rainfall duration.
- (vii) The probable maximum flood is a flood adopted in all hydraulic structures.

- (viii) The standard project flood is same as the design flood.
- (ix) The use of unit hydrograph for estimating floods is limited to catchment of sizes less than 500 km<sup>2</sup>.
- (x) For the return period of 100 years the Gumbels reduced variate is 0.517. (10×2=20)