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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Fifth Semester, B.E. - Civil Engineering

Semester End Examination; Dec - 2019

Hydrology and Water Resources Engineering

Time: 3 hrs

Max. Marks: 100

Note: Answer **FIVE** full questions, selecting **ONE** full question from each unit.

UNIT - I

- 1 a. Define precipitation. Explain types of precipitation. 7
- b. The Annual rainfalls (cm) at a place for a period of 10 years from 1971 to 1980 are respectively: 30.3, 41.0, 33.5, 34.0, 33.3, 36.2, 33.6, 30.2, 35.5, 36.3 cm. Determine the mean and median values of rainfall for the place. 5
- c. There are four rain gauge stations existing in catchment of a river. The average annual rainfall values are 800, 620, 400 and 540 mm respectively. Determine the optimum number of rain gauge in catchment, if it is desired to limit the error to 10%. How many more gauges will then be required to be Installed? 8
- 2 a. Define rain gauge. With neat sketch, explain non recording type rain gauge. 6
- b. Explain the following: 8
- i) Rain fall Hyetograph ii) Any one method of estimation of missing rainfall data.
- c. Precipitation station 'X' was inoperative for part of a month during which a storm occurred. The respective storm total at their surrounding stations A, B and C were 107, 89, and 122 mm. The normal annual precipitation values of stations X, A, B, C are respectively 978, 1120, 935 and 1200 mm. Estimate the storm precipitation for station 'X'. 6

UNIT - II

- 3 a. Define Runoff. Explain the factor affecting it. 6
- b. Explain Briefly the measurement of Evaporation by using Empirical Equation. 8
- c. The design annual rainfall for the catchment of a proposed reservoir has been computed to be 99 cm. The catchment area has been estimated to have mean annual temperature of 20°C. The catchment area contributing to the proposed reservoir is 1000 Sq .km. Calculate annual design catchment field for this reservoir. Make use of Khosla's formula. 6
- 4 a. Explain briefly method of computing infiltration capacity using infiltrometer. 6
- b. Explain briefly factors affecting Evaporation losses. 6
- c. A Reservoir with a surface area of 300 hectares has the following average meteorological values during given week. Estimate average daily evaporation from the lake reservoir and the volume of water evaporated from the lake during week. Make use of Meyer's formula as well as Rohwer's formula to compare the results. 8

Water temperature = 30°C;

Wind velocity at 1 m above ground = 12 km/h;

Relative Humidity = 50%;

Mean barometer reading = 750 mm of Hg

UNIT - III

Contd...2

- 5 a. What is Hydrograph? What is its use in Hydrology? 6
- b. What are the essential requirement of a gauge site? Explain briefly different types of gauges. 6
- c. Given below are the ordinates of a unit hydrograph for a storm of 4 hr duration. Find ordinate of flood hydrograph when maximum flood observed was 4000 m³/s and base flow was 250 m³/s. 8

| | | | | | | | |
|--|---|------|------|-----|-----|----|----|
| Time (hour)→ | 0 | 4 | 8 | 12 | 16 | 20 | 24 |
| Surface runoff (m ³ /sec) → | 0 | 1500 | 1200 | 600 | 220 | 80 | 0 |

- 6 a. During a high flow, water surface elevations of a small stream were noted at two sections A and B, 10 km apart. (A is Upstream of B) these elevations and other salient hydraulic properties are given below:

| Section | Water surface Elevations | Cross section (m ²) | Hydraulic radius (m) |
|---------|--------------------------|---------------------------------|----------------------|
| A | 104.771 | 73.293 | 2.733 |
| B | 104.500 | 93.375 | 3.089 |

10

The appropriate eddy loss coefficients are 0.3 for gradual expansion and 0.1 for gradual contractions. Estimate the discharge in stream assuming Manning’s roughness coefficient as 0.020.

- b. Write a note on:
 - i) Velocity measurement by current meter 10
 - ii) Measurement of discharge of a stream with the help of float

UNIT - IV

- 7 a. Explain briefly; i) Pumping test ii) Recuperation test. 6
- b. Derive an expression for discharge of a well in a homogeneous artesian aquifer. 6
- c. In a field test, a time of 6 hr was required for a tracer to travel through an aquifer from one well to another. Observation wells were 42 m apart and difference in their water level was found to be 0.42 m. Compute; 8
 - i) Discharge velocity ii) Coefficient of permeability (K). Porosity of soil is 20%.
- 8 a. Define Aquifer. Explain the types. 7
- b. Explain specific yield and specific Retention. 4
- c. A 30 cm diameter well penetrates 25 m below static water table. After 24 hr of pumping at 5400 lit/min. Water level in a test well at 90 m is lowered by 0.53 m and in a well 30 m away, the drawdown is 1.1m. 9
 - i) What is the transmissibility of aquifer?

ii) Also determine drawdown in a main well.

Contd...3

UNIT - V

- 9 a. Explain the procedure for determination of peak flood discharge by Empirical formula. 6
- b. Explain the following:
 - i) Rational method of flood estimation 8
 - ii) Flood Frequency Analysis
- c. A flood of a certain magnitude has a return period of 25 yrs,
 - i) What is probability of exceedance? 6
 - ii) What is the probability that this flood may occur in next 12 years
- 10 a. What is meant by total routing? Explain the types. 6
- b. Explain the following: 6
 - i) Design Flood ii) Return period iii) Probable maximum flood
- c. For a river, the estimated flood peaks for two return periods by use of Gumbel method, are given below:

| Return Period (years) | Peak flood (m ³ /s) |
|-----------------------|--------------------------------|
| 100 | 485 |
| 50 | 445 |

8

What flood discharge in this river will have a return period of 1000 years?

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