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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 - 2017 / Jan - 2018

Hydrology and Water Resources Engineering

Time: 3 hrs

Max. Marks: 100

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

ii) Assume missing data suitably.

UNIT - I

- 1 a. i) Write a neat diagram of a float type of automatic recording rain gauge. 8
- ii) Write its standard dimensions. 8
- iii) Name the component parts. 8
- iv) Explain its rainfall recording processes. 8
- b. Name the methods for mean rainfall estimation over the area. Which method is accurate? 4
- c. The mean annual rainfall at station X in cm (\bar{x}) and the mean annual rainfall at 15 surrounding stations in cm (\bar{x}_n) are given below. Check the consistency of the record at station X and determine the year in which a change in conditions had occurred. Also determine the corrected mean annual rainfall 8

Year	1972	71	70	69	68	67	66	65	64	63	62	61	60
(\bar{x})	51.5	48.5	40.5	44.1	36.0	30.0	34.8	39.7	35.5	49.4	32.0	28.0	30.3
(\bar{x}_n)	4.04	39.4	20.7	50.5	29.4	24.6	35.0	20.0	15.5	9.6	16.4	13.5	10.0

- 2 a. Explain the world water budget and Indian water budget with the support of statistical values. 7
- b. What are the Indian Meteorological Organization (IMO) recommendation for the raingauge network densities? 6
- c. Catchment has five rain gauge stations. In a year the annual rainfall recorded by the gauges are 788 mm, 902 mm, 986 mm, 1024 mm and 704 mm. For 6% error in the estimation of the mean rainfall, determine the additional number of gauges needed. 7

UNIT - II

- 3 a. (i) Write the neat diagram of a double ring infiltrometer 8
- (ii) Write its standard dimensions 8
- (iii) Name the component parts 8
- (iv) Explain infiltration measurement procedure. 8
- b. Explain Horton's infiltration equation and curve. 4

- c. A reservoir with average surface spread of 4.8 km² in the first week of November has the water surface temperature of 30° (for air $l_a = 42.430$ mb) and the relative humidity of 40%. Wind velocity measured at 3.0 above the ground is 18 km/h. The mean barometer reading is 760 mm of Hg. Calculate the average evaporation loss from the reservoir in mm/day and the total volume of evaporation loss (in cubic meter) in the first week of November. Use both Meyer's as well as Rohwer's equation. Take saturation vapour pressure at 30°C as 31.81 mm of Hg. 8
- 4 a. Explain the following; 8
- (i) Catchment area (ii) Basin yield (iii) Effective rainfall (iv) Evaporation.
- b. Define two infiltration Indices. 4
- c. The mean monthly temperature in May for November at a place of latitude 20°N. Percentage of day time hrs for May and November are 9.14 and 7.58 respectively and temperatures are 28.4°C and 20.2°C respectively. Determine the ET for sugarcane crop at this phase for those two months. 8

Cu for May	7.597 inches
Cu for November	5.182 inches
ET for May	17.37 cm
ET for November	11.19 cm

UNIT - III

- 5 a. Explain Unit Hydrograph, which is one unit hydrograph? Explain the procedure for the construction of a unit hydrograph for single storm flood hydrograph. What are the practical application of unit hydrograph. 8
- b. Find the ordinates of a storm hydrograph resulting from a 3 hour storm with rainfall of 2,6.75 and 3.75cm during sursequent 3 hours intervals. The ordinates of 3-hour unit-hydrograph are given in the following table. 12

Hours	0.3	06	09	12	15	18	21	24	03	06	09	12	15	18	21	24
Ouh m ³ /s	0	110	365	500	390	310	250	235	175	130	95	65	40	22	10	6

- 6 a. With neat diagram explain the measurement of velocity using float? 8
- b. The following data were collected at a gauging station on a stream. Compute the discharge by the mid-section method. 12

Distance one Bank (m)	0	3	6	9	12	15	18	21	24	27
Water Depth (m)	0	1.5	3.2	5.0	9.0	5.5	4.0	1.6	1.4	0
Mean Velocity (m/s)	0	0.12	0.24	0.25	0.26	0.24	0.23	0.16	0.14	0

UNIT - IV

- 7 a. Develop the equation relating the steady state discharge from a well in an unconfined aquifer and depths of water table at two known positions from the well. State clearly all the assumptions involved in your derivation. 10
- b. In an artesian aquifer of 8 m thick, a 10 cm diameter well is pumped at a constant rate of 100 lit/minute. The steady state drawdown observed in two wells located at 10 m and 50 m distance from the centre of the well are 3 m and 0.05 m respectively, compute the transmissivity and the hydraulic conductivity of the aquifer. 10
- 8 a. Define the following;
 - (i) Darcy’s Law (ii) Specific Capacity (iii) Yield of a well 10
 - (iv) Recharge of ground water (v) Storage coefficient.
- b. During a Recuperation test, the water level in an open well was depressed by pumping by 2.5 m and is recuperated by an amount of 1.6 m in 70 minutes.
 - (i) Determine the yield from the well of 3 m diameter under a depression head of 3.5 m 10
 - (ii) Also determine the diameter well to yield 10 litres/ second under a depression head of 2.5 m.

UNIT - V

- 9 a. Define flood routing. What are the uses of flood routing? 5
 - b. Show that in the level pool routing the peak of the outflow hydrograph must intersect the inflow hydrograph. 5
 - c. Route the following flood hydrograph through a river reach for which $k = 12.0$ h and $x = 0.20$, At the start of the inflow flood, the outflow, the outflow discharge is $10 \text{ m}^3/\text{s}$. 10
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|----------------------------------|----|----|----|----|----|----|----|----|----|----|
| Time (h) | 0 | 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54 |
| Inflow (m^3/s) | 10 | 20 | 50 | 60 | 55 | 45 | 35 | 27 | 20 | 15 |
- 10 a. What is meant by design flood with reference to practical application? Explain rational formula for the estimation of design flood. 10
 - b. From the analysis of available data an annual flood peaks of a small stream for a period of 35 years, the 50 year and 100 years flood have been estimated to be $660 \text{ m}^3/\text{s}$ using Grumbel’s method. Estimate the 200 year flood for the stream. Take $\bar{y}_n = 0.54034$, $\sigma_n = 1.12547$. 10

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