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

(An Autonomous Institution under VTU, Belgaum)

Fifth Semester, B.E. - Civil Engineering

Semester End Examination; Dec - 2016/Jan - 2017

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) Missing data if any, may suitably assumed.

UNIT - I

1 a. Define hydrometeorology. Describe the vertical structure of the atmosphere with respect to temperature, with the help of a neat sketch. 10

b. What is precipitation? Explain different types of precipitation with sketch. 10

2 a. Explain the working of siphon type recording rain gauge with neat sketch. 6

b. An area is composed of a square of side 8 km and an equilateral triangle placed on the left side. The annual rainfall recorded at four comers and centre of the square considered clock wise from the top left corner is 50, 65, 80, 85 and 75 cm respectively. The apex of the triangle has recorded 60 mm of annual rainfall. Find the mean rainfall over the area by Thiessen polygon method. 8

c. A catchment area has 6 rainguage stations. In a year the annual rainfall recorded by the gauges are as follows : 6

Stations	1	2	3	4	5	6
Rainfall (cms)	140.2	152.5	120.8	110.5	160.6	100.4

For a 5% error in the estimation of mean annual rainfall, calculate the optimum number of rain gauges and additional rain gauge stations required in the basin.

UNIT - II

3 a. Discuss various methods of reducing evaporation from water body. 4

b. Describe how infiltration capacity rate can be measured using double ring infiltrometer with sketch? 8

c. An infliltration test conducted on a double ring inflitrometer with an inner ring of diameter 30 cm yielded the following data, 8

Time in (min)	0	5	10	30	60	120	180	240	300	360
Cumulative vol. of water added in cm^3	0	46	90	246	435	662	842	1000	1154	1300

Determine the infiltration capacity rates for the time intervals in the test and plot the variation of infiltration capacity rates with time.

Contd…2

4 a. Define the term runoff and list the various factors that affect the runoff of a given area. 8

b. Given below are the monthly rainfall *P* and corresponding runoff *R* values covering period of 10 months for a catchment. Develop correlation equation between *R* and *P* and calculate correlation co efficient. 8

Month	1	2	3	4	5	6	7	8	9	10
Rainfall (*P*)	6	34	41	31	15	10	5	32	37	30
Runoff (*R*)	0.6	9	14.8	7.4	3.1	3.2	0.1	12	15	8.2

c. Define potential evapo-transpiration and actual evapo-transpiration. 4

UNIT - III

5 a. What is stream gauging? What are the factors should be considered in selecting a site for a stream gauging station? 6

b. Explain the stream flow measurement by Area-Velocity method. 6

c. The following field observations were obtained at two sections on a stream separated by a distance of 350 m along the stream. 8

	Area (m^2)	Perimeter (m)	Gauge reading (m)
U/S	68.1	42.3	61.38
Middle section	72.3	45.7	-
D/S	75.4	48.6	60.99

Determine the flood discharge assuming Manning's $n = 0.033$.

6 a. Describe methods of separating base flow from the total runoff. 8

b. Define unit hydrograph. Describe the step by step procedure of the derivation of a unit hydrograph from an isolated storm. 6

c. The peak ordinate of a flood hydrograph produced by 4 hour storm yielding 6.7 cm of rainfall is observed to be 832 m^3/s. If the base flow and ϕ-index are 15 m^3/s and 0.5 cm/h. What is the peak ordinate of the 4 hour unit hydrograph? 6

UNIT - IV

7 a. Distinguish between :

i) Aquitard and Aquifuge ii) Confined aquifer and Water table aquifer

iii) Influent and Effluent iv) Ground water and Perched ground water. 8

b. Derive discharge equation of a fully penetrating well in an unconfined aquifer. 6

c. A well of 0.5 m diameter penetrates fully into a confined aquifer of thickness 20 m and hydraulic conductivity 8.2×10^{-4} m/s. What is the maximum yield expected from the well, if the drawdown in the well is not to exceed 3 m. The radius of influence may be taken as 260 m. 6

Contd…3

8 a. Define terms :

i) Porosity ii) Specific yield 8

iii) Specific retention iv) Storage coefficient.

b. Explain how the yield of an open well can be determining using recuperation test and derive expression for the specific yield. 8

c. The following data is obtained from recuperation test on an open well of diameter 7.5 m,

R L of water table = 257.8 m

R L of water level in the well when the pumping is just stopped = 251.3 m 4

RL of water level in the well after 2.5 hour the pump is stopped = 255.5 m

Estimate the safe yield of the well, if the working head is 3.5 m.

UNIT - V

9 a. Define flood routing. Describe various types of flood routing. 6

b. Explain the method of the determining the Muskingum parameters k and x of a reach from a pair of observed inflow and outflow hydrograph. 6

c. Given the following inflow hydrograph to a certain steam channel reach, calculate the outflow by the Muskingum method. 8

Time (h)	0	1	2	3	4	5	6	7	8	9	10	11	12
inflow m^3/s	10	20	40	80	120	150	150	60	50	40	30	20	10

Assume initial outflow as 10 m^3/s and k = 4 h and x = 0.25.

10 a. Explain the procedure of establishing storage-discharge relationship. 8

b. Explain the method of design flood estimation using rational method. 6

c. A culvert is proposed across a stream draining an area of 185 hectares. The catchment has a slope of 0.004 and the length of travel for water is 1150 m. Estimate the 25 year flood, if the rain fall is given by : 6

$$I = \frac{1000 T_r^{0.3}}{(t+20)^{0.7}}$$

Where I is in mm/h, T_r in years and t is in minutes. Assume runoff coefficient of 0.35.

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