



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

UNIT - I

- 1 a. Define Hydrology. Explain application of hydrology. 8
- b. Define catchment and give the water budget equation for a catchment. 4
- c. A lake had a water surface elevation of 103.2m above the datum at the beginning of certain month. In that month, the lake receives an average inflow of 6 m³/s from surface runoff sources. In the same period, the outflow was observed as 6.5 m³/s. Further in that month the lake received a rainfall of 145 mm. The evaporation from the lake was estimated as 6.1cm. Calculate the water surface elevation of the lake at the end of that particular month. The average surface area of lake can be taken as 5000 ha. Assume that there is no contribution to or from the ground water storage. 8
- 2 a. Explain the methods used for the missing precipitation data (1+2+3). 6
- b. Explain the procedure of checking the adequacy of rain gauges in a catchment. 4
- c. The isohyetal map for a 24 hour storm gave area enclosed between different isohyets as below. Determine the average depth of rainfall over the basin : 10

Isohyets (mm)	21	20	19	18	17	16	15	14	13	12
Area between isohyete and basin boundary (km ²)	543	1345	2030	2545	2955	3280	3535	3710	3880	3915

UNIT - II

- 3 a. Make a note on Infiltration indices. 6
- b. What is runoff? Explain the components of runoff. 6
- c. A 6 hour rainfall event delivers 2, 4.5, 4.8, 3.2, 2.2 and 1.6 cm of rainfall in a catchment. The ϕ -indices for the catchment are 25 mm/hr for the first 30% of the area, 30 mm/hr for another 30% and 20 mm/hr for the remaining area. Estimate the average depth of runoff from the catchment. 8
- 4 a. What is evapo-transpiration? What are the factors that affect evapo-transpiration? 7
- b. Make a note on reducing reservoir evaporation. 4
- c. In a infiltration test on a ring of 35 cm diameter yielded the following data :

Time from start (min)	0	2	5	10	20	30	60	90	150	210
Cum. Volume of water added in cm ³	0	278	658	1173	1924	2500	3345	3875	4595	5315

Find;

- i) Infiltration capacity rate for the time interval in the experiment
- ii) Ultimate infiltration capacity rate
- iii) Average infiltration capacity for the first 10 min and 30 min of the experiment.

UNIT - III

- 5 a. What is stream flow? Discuss in brief the type of streams. 5
- b. Make a note on rating curve for a stream. 4

c. Compute the stream flow for the measured data given below :

Distance in m	0.0	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.6
Depth in m	0.0	0.3	1.29	2.16	2.55	2.22	1.68	1.41	1.05	0.63	0.42	0.00
$V_{0.2y}$ in m/s	0.0	0.42	0.57	0.78	0.87	0.81	0.75	0.69	0.63	0.54	0.45	0.0
$V_{0.8y}$ in m/s	0.0	0.21	0.36	0.54	0.60	0.30	0.51	0.45	0.39	0.33	0.30	0.0

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- 6 a. What is a hydrograph? With a neat sketch, explain the components of a hydrograph. 7
 b. Find the ordinates of storm hydrograph resulting from a 3 hour storm with rainfall of 2, 6.75, and 3.75 cm during subsequent 3 hour intervals. The ordinates of unit hydrograph are given in the table below. Assume an initial loss of 5 mm, infiltration index of 2.5 mm/hr and base flow of 10 cumecs :

Time in Hr.	3	6	9	12	15	18	21	24	3	6	9	12	15	18	21	24
Ordinates of unit hydrograph m^3/s	0	110	365	500	390	310	250	235	175	130	95	65	40	22	10	0

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UNIT - IV

- 7 a. Briefly discuss the importance of ground water hydrology. 6
 b. Derive an equation for yield from a well penetrating in to an unconfined aquifer with steady radial flow. 8
 c. What should be the diameter of an open well to give a safe yield of 4.8 lps? Assume the working head as 3.75 m and the sub soil consists of fine sand for which $C = 0.5 / hr$. 6
 8 a. State Darcy's law, Discuss about its validity. 5
 b. Explain the tests used for determining sale yield of well. 7
 c. A 20 cm well penetrates 30 m below static water level (GWT). After a long period of pumping at rate of 1800 lpm, the drawdown in the observation wells at 12 m and 36 m from the pumping well are 1.2 m and 0.5 m respectively. Determine;
 i) The transmissibility of the aquifer 8
 ii) The drawdown in the pumping well assuming the radius of influence as 300 m
 iii) The specific capacity of the well.

UNIT - V

- 9 a. Define flood routing. Explain Muskingum method of channel routing. 8
 b. For the inflow hydrograph shown below. Perform the routing through the reservoir reach. Assuming $K = 12$ hours and $X = 0.20$;

Time in hr	0	6	12	18	24	30	36	42	48	54
Inflow in m^3/s	10	20	50	60	55	45	35	27	20	15

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- 10a. What is design flood? Explain the rational method of estimating design flood. 10
 b. Assuming that Gumbel's distribution fits the 40 year data of stream, estimate the 100 year and 200 year flood. Given that mean of the variate = $530 m^3/s$, S D of variate = $161.547 m^3/s$, S.D of reduced variate = 1.14132 and mean of reduce variate = 0.54362. 10

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