



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

(An Autonomous Institution affiliated to VTU, Belgaum)

Fifth Semester, B.E. - Civil Engineering

Semester End Examination; Dec. - 2015

Hydrology and Water Resources Engineering

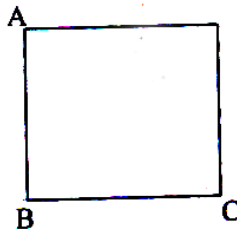
Time: 3 hrs

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. Define Hydrology. Explain briefly the practical applications of hydrology. 6
- b. Make a note on adequacy of rain gauge stations. 6
- c. The rainfall values recorded by the stations A, B and C located at three of the successive corners of a square are 20 cm, 30 cm and 34 cm respectively, during a season. Determine the area average rainfall by Thiessen polygon method and compare it with the simple average. 8



- 2 a. Explain the different types of precipitation. 6
- b. Explain with neat sketch, the measurement of precipitation with a recording type of rain gauge. 6
- c. The normal annual rainfall at six stations in an area is 85, 66, 92, 105, 118 and 74 cm respectively. Determine the error in the arithmetic mean and estimate the additional number of stations required to limit the error to 6%. 8

UNIT - II

- 3 a. Define infiltration. Explain the factors affecting infiltration. 6
- b. Make a note on pan coefficient. 4
- c. In an infiltration test on a ring of outer diameter 35 cm and 5 cm thick, yielded the following data. Find:
 - i) Infiltration rate for the time interval ii) Ultimate infiltration rate
 - iii) Average infiltration rate for the first 20 minutes of the experiment. 10

Time from start in minutes	0	2	5	10	20	30	60	90	150	210
Volume of water added cm ³	0	278	380	515	751	576	845	530	720	720

- 4 a. Explain the factors affecting runoff. 6
- b. Make a note on Infiltration indices. 5
- c. The mean monthly temperature over the basic for 12 months period from June to May are 25.8, 24.4, 23.8, 23.5, 23.6, 20.2, 17.1, 16.6, 18.5, 23.3, 27.8 and 28.4°C respectively. The observed rainfall values in mm in the corresponding months are 86, 229, 208 m 115, 15, 182, 10, 24, 24, 12, 0 and 0. Determine the annual runoff from the basin using Khosla’s formula. 9

UNIT - III

- 5 a. What is stream flow? Explain how it can be measured using slope - area method. 8
- b. Data pertaining to stream gauging operation at a gauging site is given below. The rating equation is $V = 0.51 N + 0.03$ m/s. Calculate the discharge in the stream using mid section method, 12

Distance from Bank(m)	0	1	3	5	7	9	11	12
Depth(m)	0	1.1	2	2.5	2	1.7	1	0
Revolutions	0	39	58	112	90	45	30	0
Time in sec	0	100	100	150	100	100	100	0

- 6 a. Explain the components of a hydrograph with a neat sketch. 5
- b. Define unit hydrograph. List the assumptions made in the theory of unit hydrograph. 5
- c. The ordinates of a 4-h unit hydrograph are given below. Derive the ordinates of a 12-h unit hydrograph for the basin. 10

Time in h	0	4	8	12	16	20	24	28	32	36	40	44
Ordinates of 4-h UH m^3/s	0	20	80	130	150	130	90	52	27	15	5	0

UNIT - IV

- 7 a. With a neat sketch explain a confined aquifer and unconfined aquifer. 6
- b. Define Specific yield and Specific retention. 4
- c. An unconfined aquifer has a thickness of 30 m. A fully penetrating well of a diameter 20 cm in this aquifer is pumped of 10 m and 100 m from the well is 7.5 m and 0.5 m respectively. Determine the average hydraulic conductivity of the aquifer. At what distance from the well the drawdown in insignificant? 10
- 8 a. Derive an equation for yield from a well penetrating into an unconfined aquifer with steady radial flow. 10
- b. Define transmissibility a 30 cm well fully penetrates into a confined aquifer 30 m deep. After a long period of pumping at a rate of 1200 *lpm*. The drawdowns in the wells at 20 m and 45 m from the pumping well are found to be 2.20 m and 1.80 m respectively. Determine the transmissibility of the aquifer. What is the drawdown in the pumped well? 10

UNIT - V

- 9 a. Define flood routing. Discuss different types of flood routing. 5
- b. The topographic surveys at a proposed reservoir site yielded the following data. There are two circular sluices with a diameter of 2.5 m and with their centers at an elevation of 470 m. A spillway with an effective crest length of 20 m is also provided with its sill at 480 m. The C_d for sluices may be taken as 0.8 and for spillway $C = 2.25$. Prepare the storage - discharge curve for the reservoir, 15

Contour elevation, m	470	472	474	476	478	480	482	484	486
Contour area, ha	219	227	240	257	278	303	330	362	396

- 10 a. What is design flood? Explain the rational method of estimating design flood. 8
- b. Data covering a period of 92 years for the river Ganga, yielded the mean and standard deviation of the annual flood series as 6437 and 2951 m^3/s respectively. Using Gumbel's method, estimate the flood discharge with a return period of 500 years. What are the; 12
- (i) 95% confidence limits for this estimate? Take $f(c)$ for 95% confidence limit = 1.96.
- Also, take $y_n = 0.5589$ and $S_n = 1.2020$ for 92 years.

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