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Question Paper Code : 21213

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Sixth Semester

Civil Engineering

CE 2021/CE 601/10111 CEE 11 — HYDROLOGY

(Regulations 2008/2010)

(Common to PTCE 2021 – Hydrology for B.E. (Part-Time) Fifth Semester, Civil Engineering – Regulations 2009)

Time : Three hours Maximum : 100 marks

(Referring Gumbel's Distribution Table may be permitted).

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List the transportation and storage components in the hydrological cycle.

2. A Catchment has six raingauge stations. In a year, the annual rainfall recorded by the gauges is as follows. Determine the standard error in the estimation of mean rainfall in the existing set of raingauges.

Station :	A	B	C	D	E	F
Rainfall (cm) :	82.6	102.9	180.3	110.3	98.8	136.7

3. List the various data needed to estimate the potential evapotranspiration from a given area.

4. Distinguish between field capacity and permanent wilting point.

5. What is the need to separate base flow from the flood hydrograph?

6. What is an IUH? What are its characteristics?

7. What do you understand by time of concentration of a catchment?

8. What are the limitations of flood frequency studies?

9. Distinguish between specific capacity of a well and the specific yield of an aquifer

10. What are the commonly used methods lo assess the recharge of ground water in an area?

PART B — (5 × 16 = 80 marks)

11. (a) (i) The normal annual rainfall at stations A, B, C and D in a basin are 80.97, 67.59, 76.28 and 92.01 cm respectively. In the year 1985, the station D was inoperative and the stations A, B and C recorded annual precipitation of 91.11, 72.23 and 79.89 cm respectively. Estimate the rainfall at station D in that year. (4)

(ii) In a catchment, whose shape can be approximated by a pentagon, four raingauge stations are situated inside the catchment, The coordinates of the corners of the catchment that define its boundaries and the coordinates of the four raingauge stations are given below. Also given are the annual rainfall recorded by the four stations in the year 2005. Determine the average annual rainfall over the catchment in that year by the Thiessen-mean method. (12)

Distances are in Km.		Corner a is the origin of co-ordinates				
Catchment boundary	Corner co-ordinates	Corner a (0,0)	Corner b (120,0)	Corner c (120, 80)	Corner d (60, 140)	Corner e (0, 80)
Rain gauge station	Station	P	Q	R	S	
	Co-ordinates	(40,50)	(80,20)	(80,60)	(40,80)	
	Annual rainfall (cm)	120	110	100	125	

Or

(b) (i) Explain Elaborately about the distribution of fresh water resources in the world. (8)

(ii) Describe the hydrological cycle. Explain the humankind's interference in various parts of this cycle. (8)

12. (a) (i) The infiltration capacity in a basin is represented by Horton's equation as

$$f_p = 3.0 + e^{-2t}$$

Where f_p, is in cm/h and t is in hours. Assuming the infiltration to take place at capacity rates in a storm of 60 minutes duration, estimate the depth of infiltration in the first 30 minutes and the second 30 minutes of the storm. (8)

(ii) The infiltration capacity of soil in a small watershed was found to be 6 cm/h before a rainfall event, it was found to be 1.2 cm/h at the end of 8 hours of storm. if the total infiltration during the 8 hours period of storm was 15 cm, estimate the value of the decay coefficient kh in Horton's infiltration capacity equation. (8)

Or

(b) A storm with 10 cm of precipitation produced a direct runoff of 5.8 cm. The duration of the rainfall was 16 hours and its time distribution is given below. Estimate the Φ index of the storm. (16)

Time from state (h) :	0	2	4	6	8	10	12	14	16
Cumulative rainfall (cm)	0	0.4	1.3	2.8	5.1	6.9	8.5	9.5	10.0

13. (a) Given below are the ordinates of a 6-h unit hydrograph for a catchment. Calculate the ordinates of the DRH due to a rainfall excess of 3.5 cm occurring in 6 h. (16)

Time (h) :	0	3	6	9	12	15	18	24	30	36	42	48	54	60	69
UH ordinate (m^3/s) :	0	25	50	85	125	160	185	160	110	60	36	25	16	8	0

Or

(b) Two catchments A and B are considered meteorologically similar. Their catchment characteristics are given below.

Catchment A	Catchment B
L = 30 km	L = 45 km
L_{ca} = 15 km	L_{ca} = 25 km
A = 250 km^2	A = 400 km^2

For catchment A, a 2-h unit hydrograph was developed and was found to have a peak discharge 50 m^3/s. The time to peak from the beginning of the rainfall excess in this unit hydrograph was 9.0 h. Using Snyder's method, develop a unit hydrograph for catchment B. (16)

14. (a) (i) An analysis of annual flood series of a stream indicated the mean value and standard deviation of the flood series as 940 m^3/s and 203 m^3/s respectively. What is the magnitude of a flood of return period of 500 years in this stream? Assume that the annual flood series follow Gumbel's distribution and the sample size is very large. (8)

(ii) The mean annual flood of a river 600 m^3/s and the standard deviation of the annual flood series is 150 m^3/s. What is the probability of a flood of magnitude 1000 m^3/s occurring in the river within next 5 years? Use Gumbel's method and assume the sample size to he very large. (8)

Or

(b) (i) Explain elaborately the following terms.

(1) Design flood

(2) Standard project flood

(3) Probable maximum flood

(4) Design storm. (8)

(ii) Explain the rational method of estimating the peak discharge of small catchments with its merits and demerits. (8)

15. (a) (i) A 30 cm well penetrating a confined aquifer is pumped at a rate of a 1200 lpm. The drawdown at an observation well at a radial distance of 30 m is as follows.

Time from stare (min) :	1.0	2.5	5	10	20	50	100	200	500	1000
Drawdown (m) :	0.2	0.5	0.8	1.2	1.8	2.5	3.0	3.7	4.4	5.0

Calculate the aquifer parameters S and T. (8)

(ii) A 30 cm well completely penetrates an unconfined aquifer of saturated depth 40 m. After a long period of pumping at a steady rate of 1500 lpm, the drawdown in two observation wells 25 m and 75 m from the pumping well were found to be 3.5 m and 2.0 m respectively. Determine the transmissibility of the aquifer. What is the drawdown at the Pumping well? (8)

Or

(b) (i) Explain the following :

(1) Perched water table

(2) Intrinsic Permeability

(3) Bulk porn velocity

(4) Well loss. (8)

(ii) Develop the equation relating the steady-state discharge from a well in an unconfined aquifer and depths of water table at two known position from the well. State clearly all the assumptions involved in your derivation. (8)