Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET University)

B. Tech (Fifth Semester - Regular) Examinations, November 2025

23BCVPC35002 - Water Resources Engineering

(CIVIL)

Time: 3 hrs Maximum: 60 Marks

Answer ALL questions

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

Q.1. Answer ***ALL*** questions	CO #	Blooms Level
a. Define precipitation and write at least four forms of precipitation.	CO1	K2
b. Define surface flow and subsurface flow.	CO2	K2
c. Define time of concentration.	CO3	K2
d. Determine the probability that a hundred year flood may not occur at all during 50 year life of project.	CO4	K2
e. Compare steady and unsteady flow.	CO5	K2

PART – B **(10 x 5 = 50 Marks)**

Answer ***ALL*** the questions	Marks	CO #	Blooms Level
2. a. In a 140-min storm the following rates of rainfall were observed in successive 20-min intervals: 6.0, 6.0, 18.0, 13.0, 2.0, 2.0 and 12.0 mm/h. Assuming the φ-index value as 3.0 mm/h and the initial loss of 0.8 mm, determine the total rainfall, net runoff and W-index for the storm.	5	CO1	K3
b.			

Time from start of rainfall (min)	0	20	40	60	80	100	120
Cumulative rainfall (cm)	0	0.5	1.2	2.6	3.3	3.5	4.0

The mass curve of rainfall of duration 2hours is given below. If the catchment had an initial loss of 0.6 cm and φ-index of 0.6 cm/hr, determine the: 5 CO1 K3

i. Total surface runoff

ii. W-index

(OR)

c. Explain the measurement of rainfall using various recording and non-recording gauges.	10	CO1	K3
3.a. Describe briefly the moving boat method of stream flow measurement.	5	CO2	K3
b.			

Section	0	1	2	3	4	5	6	7	8	9	10
V_R (m/s)	-	2	2	2	2	2	2	2	2	2	-
Angle made by VR with the boat direction (θ)	-	55	57	60	64	65	62	60	58	55	-
Depth (m)	-	2	3	4	4	5	4	3	3	2	-

Estimate the discharge in a river that gave the following moving-boat data. Assume the mean velocity in a vertical to be 0.95 times the surface velocity measured by the instrument. 5 CO2 K3

(OR)

c. Explain the dilution technique. 5 CO2 K3

d. Explain the stage measurement using recording gauges with neat sketch. 5 CO2 K3

4.a.

Time (h)	0	6	12	18	24	30
Ordinate of 6-h UH (m^3/s)	0	20	60	150	120	90
Time (h)	36	42	48	54	60	66
Ordinate of 6-h UH (m^3/s)	66	50	32	20	10	0

10 CO3 K3

If two storms, each of 1 cm rainfall excess and 6-h duration, occur in succession, calculate the resulting hydrograph of flow. Assume base flow to be uniform at $10 m^3/s$.

(OR)

b. The 6-h unit hydrograph of a catchment of area 1000 km^2 can be approximated as a triangle with base of 69 h. Calculate the peak ordinate of this unit hydrograph. 4 CO3 K3

c. Characteristics of two catchments M and N measured from a map are given below:

Item	**Catchment *M***	**Catchment *N***
L_{ca}	82 km	56 km
L	145 km	102 km
A	2836 km^2	1684 km^2

6 CO3 K3

For the 6-h unit hydrograph in catchment M, the peak discharge is at 200 m^3/s and occurs at 37 h from the start of the rainfall excess. Assuming the catchments M and N are meteorologically similar, determine the elements of the 6-h synthetic unit hydrograph for catchment N by using Snyder's method.

5.a. Here is the data given for a particular station. Estimate the exceedance frequencies and reoccurrence intervals using Weibull's and California formula.

Year	2000	2001	2002	2003	2004	2005	2006
Annual Rainfall (cm)	6	10	9	12	15	13	15
Year	2007	2008	2009	2010	2011	2012	2013
Annual Rainfall (cm)	11	9	7	8	12	13	14
Year	2014	2015	2016	2017	2018	2019	2020
Annual Rainfall (cm)	12	14	15	10	8	7	13

6 CO4 K3

b. A catchment of area 120 ha has a time of concentration of 30 min and runoff coefficient of 0.3. If a storm of duration 45 min results in 3.0 cm of rain over the catchment estimate the resulting peak flow rate. 4 CO4 K3

(OR)

c.

Duration (minutes)	30	60	90	120	180
Rainfall (mm)	35	45	60	90	120

5 CO4 K3

A culvert has to drain 250 ha of land with a maximum length of travel of 1.0 km. The general slope of the catchment is 0.001 and its runoff coefficient is 0.15.

	Estimate the peak flow by the rational method for designing the culvert for a 50-year flood.			
d.	A flood of a certain magnitude has a return period of 25 years. i. What is its probability of exceedance? ii. What is the probability that this flood may occurs in the next 12 years? iii. What is the risk associated with this hydrologic design?	5	CO4	K3
6.a.	Derive the condition for a triangular channel to be most economical.	5	CO5	K3
b.	A rectangular concrete channel (N=0.012) is to be designed to convey a discharge of 8.43 m^3/s at a velocity of 0.7 m/s, the bed slope being 0.00006. Determine the width and depth of the section.	5	CO5	K3
	(OR)			
c.	Describe the specific energy curve. Also, explain the critical depth.	5	CO5	K3
d.	A trapezoidal channel has side slopes of 3 horizontals to 4 vertical and slope of its bed is 1 in 2000. Determine the optimum dimensions of the channel, if it is to carry water at $0.5m^3/s$. Take Chezy's constant as 80.	5	CO5	K3

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