

**BACHELOR OF ENGINEERING (CIVIL ENGINEERING) EXAMINATION 2023**  
**2<sup>nd</sup> Year 2<sup>nd</sup> Semester**  
**SUBJECT: Hydrology**

Full Marks 100  
(50 marks for each part)

Time: Three hours

Use a separate Answer-Script for each part

Q No.	Part I (50 Marks)	Marks												
	<b>Answer question no.1 (compulsory) and any three from the rest. Assume relevant data if necessary.</b>													
Q1. a)	<b>Fill in the blanks:</b>	1×10=10												
i.	For extratropical-cyclone, in the southern hemisphere the wind flows in _____ direction.													
ii.	In DAD curves maximum average depth may be _____ with increasing area for a given time.													
iii.	The consistency of rainfall data for a particular area is checked using _____													
iv.	To reduce evaporation on a waterbody the commonly used chemical is _____													
v.	For one point measure, the stream velocity is measured at _____													
vi.	The instrument used for measuring stream velocity for moving boat method is _____													
vii.	Full form of AET is _____													
viii.	To simulate the evaporation rate for a water body the evaporation rate data obtained from a evaporimeter is multiplied by _____													
ix.	If pressure of a particular area decreased then the evaporation rate will be _____													
x.	The return period of 24 hour maximum rainfall equal to or greater than 200 mm in Kolkata is _____ if the probability of occurrence is 0.025.													
b)	<b>Distinguish Between:</b>	2.5												
i.	Isopluvial line and Isohyet	×4=10												
ii.	Infiltration capacity and field capacity													
iii.	W-index and $\phi$ -index													
iv.	Evaporation and Evapotranspiration													
Q 2.a)	<b>Match the following:</b>	1×5												
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Column A</th> <th style="width: 50%;">Column B</th> </tr> </thead> <tbody> <tr> <td>i. Precipitation</td> <td>a. Bubble guage</td> </tr> <tr> <td>ii. Evaporation</td> <td>b. Green Ampt equation</td> </tr> <tr> <td>iii. Evapotranspiration</td> <td>c. Symon's gauge</td> </tr> <tr> <td>iv. Infiltration</td> <td>d. Blaney Criddle's formula</td> </tr> <tr> <td>v. Streamflow</td> <td>e. Meyer's formula</td> </tr> </tbody> </table>	Column A	Column B	i. Precipitation	a. Bubble guage	ii. Evaporation	b. Green Ampt equation	iii. Evapotranspiration	c. Symon's gauge	iv. Infiltration	d. Blaney Criddle's formula	v. Streamflow	e. Meyer's formula	
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b)	The catchment area of a reservoir is 30 km <sup>2</sup> . A uniform precipitation of 0.5 cm/h for 2h was observed on 31 <sup>st</sup> October, 2022 at 8am. 50% of the runoff reached the reservoir. A canal carrying a discharge of 1.5m <sup>3</sup> /s is taken from the reservoir. The rate of evaporation observed was 0.8 mm/m <sup>2</sup> /h. The seepage loss was observed to be 50% of the evaporation loss. Find the change of level of the reservoir on 31 <sup>st</sup> October from 8 am to 8 pm. Consider the area of the reservoir is 0.5km <sup>2</sup> .	5												

[ Turn over

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Q No.	Part I (50 Marks)	Marks																																	
Q3.a)	Write the two advantages of Isohyetal method over Thiessen method for calculating average rainfall for a particular catchment area.	2																																	
b)	The annual precipitation of the rain gauge station A for the year 2013 to 2022 was provided below along with the average precipitation of five neighbouring stations for the same period. Check the consistency of the data graphically.	8																																	
	<table border="1"> <thead> <tr> <th>Year</th> <th>2013</th> <th>14</th> <th>15</th> <th>16</th> <th>17</th> <th>18</th> <th>19</th> <th>20</th> <th>21</th> <th>2022</th> </tr> </thead> <tbody> <tr> <td>Precipitation at A (mm)</td> <td>1388</td> <td>1412</td> <td>1398</td> <td>1443</td> <td>1384</td> <td>1456</td> <td>1412</td> <td>1727</td> <td>1710</td> <td>1690</td> </tr> <tr> <td>Avg. Precipitation at neighbouring stations (mm)</td> <td>8250</td> <td>8539</td> <td>8157</td> <td>8755</td> <td>8242</td> <td>8852</td> <td>8450</td> <td>9247</td> <td>8848</td> <td>8656</td> </tr> </tbody> </table>	Year	2013	14	15	16	17	18	19	20	21	2022	Precipitation at A (mm)	1388	1412	1398	1443	1384	1456	1412	1727	1710	1690	Avg. Precipitation at neighbouring stations (mm)	8250	8539	8157	8755	8242	8852	8450	9247	8848	8656	
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Q4. a)	<b>Write true or false:</b> i. If slope of an area will be flat then rate of runoff will increase. ii. If temperature of water increase then rate of infiltration will decrease.	1×2																																	
b)	Results of an infiltrometer tests of a catchment area are provided below. Determine the Horton's infiltration capacity equation graphically for the area.	8																																	
	<table border="1"> <tbody> <tr> <td>Time from the beginning of storm (min)</td> <td>5</td> <td>10</td> <td>15</td> <td>20</td> <td>30</td> <td>40</td> <td>60</td> <td>80</td> <td>100</td> </tr> <tr> <td>Cumulative infiltration in mm</td> <td>21.5</td> <td>37.7</td> <td>52.2</td> <td>65.8</td> <td>78.4</td> <td>89.5</td> <td>101.8</td> <td>112.6</td> <td>123.4</td> </tr> </tbody> </table>	Time from the beginning of storm (min)	5	10	15	20	30	40	60	80	100	Cumulative infiltration in mm	21.5	37.7	52.2	65.8	78.4	89.5	101.8	112.6	123.4														
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Q5. a)	<b>Write true or false:</b> i. For area velocity method the stretch having back water effect will be considered as best area for taking measurement of area and velocity of river. ii. For ultrasonic method pollutant load is the major drawback of streamflow measurement. iii. For slope area method unsteady river stretch should be considered. iv. Mixing length is one of the limitations for dilution technique.	1×5																																	

Ref No. -Ex/CE/5/T/204/2023

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Time: Three hours

Full Marks 100  
(50 marks for each part)

Use a separate Answer-Script for each part

<b>Q No.</b>	<b>Part I (50 Marks)</b>	<b>Marks</b>
Q5.b)	v. For streamflow measurement by electromagnetic method tidal fluctuation will hamper the measurement. 20L of water with salt concentration 30g/L was added to a flowing stream. After through mixing the concentrations were noticed at downstream at 5min intervals were 0, 5, 10, 15, 20, 10, 5, 0ppb respectively. Determine the streamflow.	5

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**BACHELOR OF ENGINEERING (Civil Engg) 2023**  
**SECOND YEAR 2ND SEMESTER**  
**SUBJECT :- HYDROLOGY**

Time: 3 hours

Full Marks: 50

Instructions: Use Separate Answer scripts for each part.

## Part – II

Answer any four ( 4 ) questions .Two ( 2 ) marks are reserved for neatness .

Sl. No.	Question	CO	Marks
1	( a ) Describe with neat sketch of different types of aquifers observed in sub-surface water (b) What do you mean by ground water table? What is aquitard? (c) Explain briefly the term “ Radius of influence” .		[6] [4] [ 2]
2	( a ) State and explain Darcy’s Law for groundwater flow. How we can get the definition of hydraulic conductivity from the above law?  (b) A 200mm gravel packed well is pumping at the rate of 1500 lit/sec in a confined aquifer of thickness 30.0m The gravel pack is 100mm thick with $d_{10} = 0.40\text{mm}$ and $d_{50} = 0.65\text{mm}$ . the region for which Darcy’s law is valid given as $Re = 10$ and $Re = 2$ Assume $v = 1.0 \times 10^{-6} \text{ m}^2/\text{sec}$ . Check also the application validity of Darcy’s law		[2+3]  [ 7]
3	A 300 mm dia well penetrates 25 m below the static water table. After 24 hrs of pumping 2 5400 Lts / min the water level in the test well located at 90 m is lowered by 53 cm and in a well 30m away the drawdown is found to be 111cm. Estimate ( i ) Permeability ( K ) ( ii ) Transmissibility Coefficient ( T )  Deduce the necessary equation for solving the problem		[12]
4.	( a ) What is meant by Unit hydrograph? What is its significance?  ( b ) Given below are observed from a storm of 6-h duration on a stream with a catchment area of 500 km <sup>2</sup> . Time in h,      0 6 12 18 24 30 36 42 48 54 60 66 72 Flow In m <sup>3</sup> /sec      0 100 250 200 150 100 70 50 35 25 15 5 0  Assuming base flow is zero, derive the ordinates of 6-h unit hydrograph and draw also DRH and UH		[4]  [8]
5	( a ) An outfall has to drain 400 ha of land with a maximum length of travel of 1.6 km. The general slope of the catchment is 1 in 700 and its run off Co-eff. is 0.40. Estimate the peak flow by the Rational method for designing the culvert for a 50 year flood. Information on the 50 year storm is given below:- Duration in (min) – 10 15 30 45 60 100 Rainfall (mm) – 25 30 45 65 80 95 ( b ) What are the limitation in rational formula ?		[2+2]