

Time: Three hours

Use a separate Answer-Script for each part

No. of Questions	Part I (60 Marks)	Marks
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Answer all the questions. Answer should be brief and to the point. All the notations have their usual meaning. Assume relevant data if not provided. All-the-relevant drawings should be in-pencil.

Q1. Write two human interventions on hydrological cycle. What do you mean by 'residence time' in hydrological cycle? Write two advantages of isohyetal method over Thiessen polygon method to determine mean precipitation for an area. Define PWP. The 25 year 24 hour maximum rainfall for Kolkata is 160mm. Determine the probability of a 24 hour rainfall equal to greater than 160 mm at Kolkata at least once in 10 successive years. 2×5

Q 2.a) Explain how ambient temperature and ambient pressure affects evapotranspiration process? Differentiate between: Field capacity and infiltration capacity; ϕ -index and W-index; stem flow and through fall 2×4

b) Results of an infiltrometer test on a soil are as follows. Establish the Horton's equation. 7

Time since start (min)	5	10	15	20	30	40	60	120	150
Accumulated infiltration (mm)	1.0	1.8	2.5	3.1	4.2	5.1	6.6	11.0	12.9

Q 3.a) Write the significance of two step procedure in stream flow measurement. State the assumptions regarding flow that are considered in slope area method of streamflow measurement? For moving average method of measurement of stream discharge, the average velocity is determined at _____. 2×2+1

b) Discuss the advantages and disadvantages of electromagnetic method over area-velocity method of discharge measurement. 5

c) Check the feasibility of using dilution technique for a river of discharge $75\text{m}^3/\text{s}$ 4+1

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	having width =40m, depth =3m, Chezy's coefficient =20 with proper justification.	
Q4.a)	Differentiate between: perched aquifer and leaky aquifer; hydraulic resistance and hydraulic diffusivity; specific yield and storativity.	2×3
b)	Write true or false with proper justification:	
	i. The unit of compressibility of aquifer is N/cm^2	1×4
	ii. Hydraulic conductivity is the function of both the soil particles and fluid properties	
	iii. Actual velocity through soil and discharge velocity are synonymous	
	iv. The rate of recovery for confined aquifer is more than rate of recovery of unconfined aquifer	
c)	With neat sketch, deducing the expression for a 30 cm dia well completely penetrating in confined aquifer of depth 25m at a steady state condition determine the drawdown in the well when coefficient of permeability is 45m/d, radius of influence is 350m and constant rate of discharge is 42lps.	5+2+3

SUBJECT: WATER RESOURCES ENGINEERING I

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Full Marks 100

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No. of Questions	Part II(Marks:40)	Marks																																																							
Q3. a)	<p>During high flood, a river reach of 1 km apart following information available.</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 50%; text-align: center;">Upstream</td> <td style="width: 50%; text-align: center;">Downstream</td> </tr> <tr> <td>Cross section 180 km²</td> <td>Cross section 180 km²</td> </tr> <tr> <td>Wetted perimeter 50m</td> <td>Wetted perimeter 50m, n_2 0.025</td> </tr> <tr> <td>N_1 0.030</td> <td>R.L of water 78.0 m</td> </tr> <tr> <td>R.L. of the water 78.30 m</td> <td></td> </tr> </table> <p>Compute the flood discharge in the river neglecting the losses.</p>	Upstream	Downstream	Cross section 180 km ²	Cross section 180 km ²	Wetted perimeter 50m	Wetted perimeter 50m, n_2 0.025	N_1 0.030	R.L of water 78.0 m	R.L. of the water 78.30 m		(5)																																													
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b)	<p>A small water shed consists of 1.5 km² of cultivated land (run off coeff 0.02), 2.5km² under forest (run off coeff 0.10), and 1 km² under grass cover (run off coeff 0.35). There is a fall of 10 m in the water course of length 2.6 km. The I-D-F depicts the following relationship for intensity of rain</p> $I = 72 T^{0.20} / (t+12)^{0.5}$ <p>Where I = Intensity in cm/h, t = min, T = yr of record, frequency in yr Estimate the Run off the basin with peak value in m³/sec for 25 years record. Use Kirpich equation and Rational formula for solving the problem.</p>	(5)																																																							
Q4.	<p>The rating curve of a current meter used for measurement of velocity in a small river is given equation $V=0.62 N+0.032$ m/sec, where N is revolution /sec. Calculate the discharge of the river from the following data. Velocity is measured at mid section.</p>																																																								
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b)	<table border="0" style="width: 100%;"> <tr> <td>Distance from the bank (m)</td> <td>0</td> <td>2</td> <td>5</td> <td>8</td> <td>12</td> <td>15</td> <td>18</td> <td>21</td> <td>23</td> <td>24</td> </tr> <tr> <td>Depth</td> <td>0</td> <td>0.60</td> <td>1.2</td> <td>1.8</td> <td>2.4</td> <td>1.9</td> <td>1.4</td> <td>1.1</td> <td>0.50</td> <td>0</td> </tr> <tr> <td>N</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>At 0.6 d</td> <td>0</td> <td>60</td> <td>90</td> <td>120</td> <td>150</td> <td>140</td> <td>100</td> <td>80</td> <td>50</td> <td>0</td> </tr> <tr> <td>Time (sec)</td> <td>0</td> <td>150</td> <td>140</td> <td>140</td> <td>160</td> <td>140</td> <td>140</td> <td>140</td> <td>140</td> <td>0</td> </tr> </table>	Distance from the bank (m)	0	2	5	8	12	15	18	21	23	24	Depth	0	0.60	1.2	1.8	2.4	1.9	1.4	1.1	0.50	0	N											At 0.6 d	0	60	90	120	150	140	100	80	50	0	Time (sec)	0	150	140	140	160	140	140	140	140	0	(10)
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Part II(Marks:40)

No. of Questions		Marks																										
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Q1.	<p>Given below are observed from a storm of 4-h duration on a stream with a catchment area of 500 km².</p> <table border="0" style="width: 100%;"> <tr> <td style="padding-right: 10px;">Time in h,</td> <td>0</td><td>4</td><td>8</td><td>12</td><td>16</td><td>20</td><td>24</td><td>28</td><td>32</td><td>36</td><td>40</td><td>44</td> </tr> <tr> <td style="padding-right: 10px;">UH Ordinate</td> <td>0</td><td>20</td><td>80</td><td>130</td><td>150</td><td>130</td><td>90</td><td>52</td><td>27</td><td>15</td><td>5</td><td>0</td> </tr> </table> <p>Assuming base flow is zero, derive the ordinates of 12-h unit hydrograph and draw also DRH and UH</p>	Time in h,	0	4	8	12	16	20	24	28	32	36	40	44	UH Ordinate	0	20	80	130	150	130	90	52	27	15	5	0	10
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Q2.	<p>a) Rational formula is used to arrive at designed peak flow for a value of Q_p. If the storm intensity gets doubled and the duration is enhanced 3 times, what will be the resulting peak in terms of Q_p?</p> <p>b) What is two point methods for measurement of stream flow?</p> <p>c) A 5-h UH of a catchment is triangular in shape with a base width of 100 hr and peak discharge of 20 m³/sec. Determine the area of catchment for this hydrograph.</p> <p>d) What are the limitations of an Unit hydrograph? Can ERH overcome these limitations?</p> <p>e) A basin is made of 70% area of runoff coeff 0.30, and remaining with 0.70. What will be the composite runoff coeff for estimation of flood?</p>	(5x 2 =10)																										