

SUBJECT: HYDROLOGY

Full Marks 30/100

Time: ~~Two hours~~/Three hours/~~Four hours~~/Six hours

Use a separate Answer-Script for each part

No. of Questions	Part I (Marks:60)	Marks
	<p style="text-align: center;">Answer Question No. 1 (Compulsory) and any three(3) from the rest.</p> <p style="text-align: center;">Assume relevant data if necessary</p> <p>1. Answer any five (5) question from the followings:-</p> <p>a) In a hydrograph plot, base flow in the beginning and at the end may not have the same value. Explain the reason of variation.</p> <p>b) Explain soil-aeration –water zone with a neat sketch.</p> <p>c) Why the product of recession coefficients cannot exceed unity.</p> <p>d) How the peak of a hydrograph is skewed? State and explain the condition clearly with sketch.</p> <p>e) What are the limitation of rational method and empirical formula for estimation of Flood discharge?</p> <p>f) What do you mean by intrinsic permeability? Write down the factors on which K_i value is not influenced.</p> <p>g) A pumping test was carried out to validate the yield of a well by incorporating aquifer constants data derived from neighboring site. The yield rate did not contemplated even the dia. of both the wells were same. Explain your answer with plausible reasons.</p> <p>h) Illustrate with a figure sketch 2hr, 12hr and 24hr unit hydrograph for the same watershed of similar basin characteristics.</p> <p>i) Check when the Darcy's law is applicable for a particle in the porous medium of mean size 0.06inch. The temperature of water is 60°F, $\nu = 1.21 \times 10^{-5}$ ft/sec. The value of moving water through the medium is 0.75ft/day</p> <p>j) A watershed of area 90ha has a runoff co-efficient of 0.4. What would be the peak discharge in m^3/sec for a storm of duration larger than the time of concentration of the watershed and intensity 4.5cm/hr.</p> <p>2. a) An aquifer has a semi – pervious layer both at the bottom and top sides with hydraulic resistance of the top and bottom layer as 3800 and 3300days respectively, compute the leakage factor.</p> <p>b) State Darcy's law and its significance. 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 $d_{10} = 0.40mm$ and $d_{50} = 0.65mm$. the feigion for which Darcy's law is valid given as $Re=10$ and $Re= 2$ Assume $\nu = 1.0 \times 10^{-6} m^2/sec$. Check also the application validity of Darcy's law.</p>	<p style="text-align: center;">5X3=15</p> <p style="text-align: center;">4</p> <p style="text-align: center;">7</p>

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	<p>c) Estimate the average drawdown over an area of 150 km² through which 25×10⁶ m³ of water has been released through several wells uniformly distributed. The specific yield of the unconfined aquifer is 25%</p>	4																																																							
3.	<p>a) Determine the hydraulic conductivity (k) and transmissibility (T) for an artesian aquifer being pumped by a fully penetrating well 30m thick and composed of medium sand. The steady state pumping rate is 3200 lpm. The drawdown at an observation well at 16 m away is 3m and a second observation well 160m away is 0.300 m. Deduce necessary equation with a neat sketch for solving the above problem.</p>	10																																																							
	<p>b) An aquifer serves 40 wells for about 250 days pumping to irrigate 930 sq. km. area. The aquifer is confined and 22m thick. The average maximum and minimum piezometric level variation range between 5-12m. Assume storage coefficient is 0.001. Estimate the average well yield.</p>	5																																																							
4.	<p>A storm event of October 2015 of Subarnarekha river is given below:</p> <table border="1" data-bbox="319 929 1364 1108"> <tr> <td>Average Catchment rainfall (mm)</td> <td>7.76</td> <td>33.72</td> <td>8.16</td> <td>0</td> <td>0</td> <td>4.26</td> <td>4.94</td> </tr> <tr> <td>Time (06/10/2015-07/10/2015)</td> <td>21</td> <td>24</td> <td>03</td> <td>06</td> <td>09</td> <td>12</td> <td>15</td> </tr> </table> <p>Catchment area of the basin is 5870 sq.km.</p> <table border="1" data-bbox="295 1131 1372 1299"> <tr> <td>Date</td> <td colspan="3">06/10/2015</td> <td colspan="3">07/10/2015</td> <td colspan="3">08/10/2015</td> <td colspan="3">09/10/2015</td> </tr> <tr> <td>Time (h)</td> <td>24</td> <td>6</td> <td>12</td> <td>18</td> <td>24</td> <td>6</td> <td>12</td> <td>6</td> <td>12</td> <td>18</td> <td>24</td> <td>6</td> </tr> <tr> <td>Q (m³/sec)</td> <td>100</td> <td>610</td> <td>1860</td> <td>1570</td> <td>970</td> <td>700</td> <td>540</td> <td>260</td> <td>217</td> <td>192</td> <td>172</td> <td>150</td> </tr> </table>	Average Catchment rainfall (mm)	7.76	33.72	8.16	0	0	4.26	4.94	Time (06/10/2015-07/10/2015)	21	24	03	06	09	12	15	Date	06/10/2015			07/10/2015			08/10/2015			09/10/2015			Time (h)	24	6	12	18	24	6	12	6	12	18	24	6	Q (m ³ /sec)	100	610	1860	1570	970	700	540	260	217	192	172	150	15
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5.	<p>Estimate the infiltration index (φ) and excess rainfall. Calculate DRH. The observed storm flow data with hydrograph ordinates is given below. Plot DRH, ERH and also φ index</p> <p>a) Estimate the flood discharge from various empirical methods given herewith</p> <ul style="list-style-type: none"> i) Ali Nawaz J. Bahadur ii) Dickens iii) Iszkowki's iv) Inglis formula <p>Assume the following values : A = 950km² C_N = 54 C₁ = 0.70 H = 1750 M = 3.75 C_D = 22.0</p> <p>Give your comment with reasonable justification, if the values of flood discharge are widely varied,</p>	8																																																							

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5	<p>b) An outlet is to be designed for a small town covering 12km² of which road area is 30%, residential area is 50% and the rest is grassy and green turfs. The slope of the catchment is 0.005 and the maximum length of the town measured on the map is 1.6km. Form depth -duration analysis for the catchment, the following information are obtained :</p> <table border="1" data-bbox="363 616 1273 728"> <tbody> <tr> <td>Rainfall duration (min)</td> <td>30</td> <td>40</td> <td>45</td> <td>50</td> </tr> <tr> <td>Rainfall depth</td> <td>30</td> <td>40</td> <td>42</td> <td>47</td> </tr> </tbody> </table> <p>Estimate the peak discharge. Assume C for road =0.80 , residential area = 0.50 and rest = 0.15</p>	Rainfall duration (min)	30	40	45	50	Rainfall depth	30	40	42	47	7
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B.E.C.E. 2nd YEAR EXAMINATION, 2019
(2nd Semester)
SUBJECT: Hydrology

Full Marks 100

Time: Three hours

Use a separate Answer-Script for each part

No. of
Questions

Part I (40 Marks)

Marks

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 PMP. The 50 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 25 successive years. 2×5
- Q 2.a) Explain how ambient temperature and ambient pressure affects evaporation process? Differentiate between PET and AET? Differentiate between infiltration rate and infiltration capacity? What is ϕ -index? 2×4
- b) To determine the infiltration capacity of a soil, experiments were done using single ring infiltrometer of diameter 20cm. Using the data obtained from the experiments determine the Horton's equation for infiltration capacity graphically. 7
- | | | | | | | | | | |
|-------------------------------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| Time (min) | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 | 80-90 |
| Accumulated infiltration (mm) | 3.34 | 5.54 | 7.13 | 8.37 | 9.42 | 10.37 | 11.26 | 12.12 | 12.98 |
- Q 3.a) Why two step procedure is followed in stream flow measurement? State the assumptions regarding flow that are considered in slope area method of streamflow measurement? During three-point method of measurement of velocity the average velocity is determined as _____. 2×2+1
- b) Discuss the advantages and disadvantages of electromagnetic method over area-velocity method of discharge measurement. 5

Ref No. -Ex/CE/T/224/2019

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(2nd Semester)
SUBJECT: Hydrology

Full Marks 100

Time: Three hours

Use a separate Answer-Script for each part

No. of Questions	Part I I(40 Marks)	Marks
Q3. c)	A 200 g/l solution of common salt was discharged into a stream at a constant rate of 25l/s. The background concentration of the salt in the stream water was found to be 10 ppm. At a downstream section where the solution was believed to have been completely mixed, the salt concentration was found to reach an equilibrium value of 45ppm. Estimate the discharge in the stream with neat schematic diagram of concentration change with time.	5