

Ref no:- Ex/ CE/5/T/204/2022

**BACHELOR OF ENGINEERING (CIVIL ENGINEERING) EXAMINATION, SECOND YEAR, 2ND Semester
Examination 2022**

SUBJECT:- HYDROLOGY

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Full Marks 100

Part:- I (50 Mks)

Time :-3hour

Answer any three (3) question papers.

Two (2) marks for neatness and to the point answers.

Assume relevant data if required.

Question No. 1.

- Explain Sub –surface water zone with a neat sketch.
- What are different types of aquifers? Describe briefly each of them.
- It is observed in a field test that 5h 10 min is the time required for a tracer to travel from one well to another 100 m apart and difference in elevation of their water surface is 1.8m. The porosity of the aquifer is found to be 10%. Avg grain size d_{10} is 1 mm and v is 0.008 Stoke. Check the Reynolds no to explore the application of Darcy Law. Calculate the intrinsic permeability in Darcy. (4+ 4+ 8)

Question No. 2.

- State and explain Darcy's Law for groundwater flow. How we can get the definition of hydraulic conductivity from the above law?.
- A 300 mm dia well penetrates 25 m below the static water table. After 24 hrs of pumping 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. (4+12)

Question 3.

- a) What is meant by Unit hydrograph? What is its significance for estimation of run-off ?
b) Explain briefly the methods of base flow separation in a flood hydrograph?
c) Given below are observed from a storm of 6-h duration on a stream with a catchment area of 500 km².

Time in h,	0	6	12	18	24	30	36	42	48	54	60	66	72
Flow In m ³ /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

(3+ 4+9)

Question 4.

- a) Define the following terms in connection to surface run off

Intermittent stream, Virgin flow, Ephemeral stream. Runoff coefficient.

- b) Compare the flood discharge values using following empirical formula for catchment area of 145 km².

i) Dickens

ii) Inglis

$$C_D = 24$$

- c) 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 800 and its run off Co-eff. is 0.35. 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

(6 + 4 + 6)

Time: Three hours

(50 marks for each part)

Use a separate Answer-Script for each part.

No. of Questions	Part II	Marks
Answer question no.1 (compulsory) and any three from the rest. Assume relevant data if necessary.		
Q1. a)	Fill in the blanks:	1×10
	i. The probable-maximum depth of precipitation over a catchment is given by the relation _____ ii. Evapotranspiration is measured using _____ iii. Evaporation is confined in _____ iv. Stearyl alcohol is used to control _____ v. The consistency of the rain gauge records is checked by _____ vi. In a river having flood flow the surface velocity is measured at a depth _____ below surface. vii. The maximum rate at which a given soil at a given time can absorb water is defined as _____ viii. The dissolved salt in water _____ the rate of evaporation ix. The precipitation above which all the precipitation contribute surface runoff is known as _____ x. In DAD curves maximum average depth may be _____ with duration for a given area.	
	b) Write short note on (Any two)	5 ×2=10
	i. Horton's Infiltration model ii. Anthropogenic interferences on hydrological cycle iii. Interception loss	
Q 2.	Distinguish between	
	a. Field capacity and infiltration capacity b. Anti cyclone and extratropical cyclone c. Warm front and cold front d. PET and PMP	2.5×4=10
Q 3.a)	Why pan coefficient is required to be used for simulating evaporation of a water body?	2
	b) What are the effect of water temperature and extent of saturated layer on infiltration rate.	2

Time: Three hours

(50 marks for each part)

Use a separate Answer-Script for each part

No. of Questions	Part II	Marks																						
c)	On the basis of rainfall data the 25 year-24 hr maximum rainfall at Kolkata is found 170 mm. Determine the probability of 24 hour rainfall of magnitude 170 mm occurring at Kolkata: I) Once in ten successive years II) Not occurring in ten successive years III) At least once in ten successive years	1+2+1+2																						
Q 4.	The mass curve of an isolated storm in a 500 ha watershed is as follows: <table border="1"> <tr> <td>Time since start (min)</td> <td>0</td> <td>2</td> <td>4</td> <td>6</td> <td>8</td> <td>10</td> <td>12</td> <td>14</td> <td>16</td> <td>18</td> </tr> <tr> <td>Cumulative rainfall (mm)</td> <td>0</td> <td>8</td> <td>26</td> <td>28</td> <td>41</td> <td>73</td> <td>108</td> <td>118</td> <td>124</td> <td>126</td> </tr> </table> <p>If the direct runoff produced by the storm is measured at the outlet of the watershed as 0.34 Mm^3, estimate the Φ-index of the storm and duration of the excess rainfall. Also plot the hyetograph to show the Φ-index.</p>	Time since start (min)	0	2	4	6	8	10	12	14	16	18	Cumulative rainfall (mm)	0	8	26	28	41	73	108	118	124	126	10
Time since start (min)	0	2	4	6	8	10	12	14	16	18														
Cumulative rainfall (mm)	0	8	26	28	41	73	108	118	124	126														
Q5.	Write the assumptions of slope area method for stream flow measurements. It is proposed to adopt the dilution method of streamgauging for a river whose hydraulic properties at average flow are as follows: width 45m, depth=2m, discharge $85 \text{ m}^3/\text{s}$, Chezy's coefficient =25. Determining safe mixing length justify whether dilution technique is feasible to be adopted for the stream. Write the two basic advantages of electromagnetic methods. Write the two basic disadvantages of ultrasonic methods.	2+3+1+2+2																						