Ref. No. ***Ex/CE/PE/B/T/415C/2025***

BACHELOR OF ENGINEERING IN CIVIL ENGINEERING EXAMINATION 2025

(Fourth Year, First Semester)

Water Resources Engineering IE

[WRE IE]

Time: Three Hours

Full Marks 100

[Part I: 50 + Part II: 50]

Use a separate Answer-Script for each part. Each part carries equal marks

Q No	**Part I (50 Marks)**		Marks
	*Attempt **all Questions** in this Part* *Assume suitable values for the parameters if not supplied*		
1	Define and explain the utility of rating curve. Draw a rating curve, on an appropriate graph sheet, for the discharge 85 m^3/s, assuming initial gauge reading as 4.0m, and the increment of water level is 0.2m/hr for 24 hours	**CO3**	5+5=**10**
2	Estimate the discharge of a particular location of a stream for the data tabulated below.	**CO4**	**10**

Gauge Distance from Initial Point at Bank of the Stream (M)	Depth, d (m)	Mean Velocity v (m/s)	Gauge Distance from Initial Point at Bank of the Stream (M)	Depth, d (m)	Mean Velocity v (m/s)
0	0.0	0.00	180	5.7	2.25
10	3.1	0.37	190	5.1	2.05
30	4.4	0.87	210	6.0	1.44
50	4.6	1.09	225	6.5	1.32
70	5.7	1.34	240	7.0	1.20
90	4.5	1.36	255	7.2	1.04
110	4.4	1.39	270	6.2	0.86
130	5.4	1.42	285	5.5	0.45
150	6.1	2.03	300	3.6	0.26
160	5.8	2.22	315	0.0	0.00

Q No			Marks
3	The values of annual precipitation in a particular area from 1960 to 2009 has been given in the following table. Use this data to plot the time series curve and the frequency histogram. Also estimate the probability of the annual precipitation in any year to be occurred less than 30mm; greater than 40mm and in between them.	**CO4**	**10**

Year	0	1	2	3	4	5	6	7	8	9
1960	35.2	35.3	37.4	35.6	36.2	37.4	33.2	36.2	32.9	35.3
1970	38.3	35.2	37.4	36.7	37.8	36.9	38.2	36.8	35.2	33.0
1980	37.5	35.7	36.5	32.5	28.9	33.6	35.2	38,3	39.0	38.6
1990	32.4	41.2	42.3	40.5	40.6	40.1	41.2	42.5	43.2	42.3
2000	30.1	43.7	44.1	43.9	43.2	39.0	41.8	40.0	40.9	40.1

Q No			Marks
4	Calculate the sample mean, sample standard deviation, and sample coefficient of skewness of the annual precipitation (in mm) given below:	**CO3**	**20**

Year	Annual Precipitation (mm)	Year	Annual Precipitation (mm)	Year	Annual Precipitation (mm)	Year	Annual Precipitation (mm)
1993	33.2	1997	35.5	2001	32.2	2005	33.4
1994	31.6	1998	37.2	2002	34.5	2006	38.6
1995	28.5	1999	32.4	2003	34.2	2007	40.6
1996	29.2	2000	42.6	2004	30.1	2008	35.4

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B.E.C.E. 4th YEAR EXAMINATION, 2025

1ST SEMESTER

SUBJECT: WATER RESOURCES ENGINEERING IE

TIME: THREE HOURS | FULL MARKS:100

USE A SEPARATE ANSWER-SCRIPT FOR EACH PART

No. of Questions	Part-II (Marks 50)	Marks
	Answer all the questions. Answer should be brief and to the point. Use pencil for any sketch. Assume any relevant data if not provided. Abbreviations have their usual meanings.	
	Section-A (CO-1)	
Q1.	With neat labelled sketch establish the Laplace equation of groundwater flow for a homogeneous isotropic confined aquifer. Applying this equation determine discharge per unit width of a confined aquifer of depth 5m and permeability 1.5m/day connecting two waterbodies of head 12m and 9m respectively and 4km apart. What will be shape of water table for this case? What will be shape of the water table for the same condition when the water bodies are separated by an unconfined aquifer with recharge from the top. What do you mean by water divide for waterflow through confined aquifer?	2+5+4 1+1 +2
Q2. (a)	Discuss the process of molecular diffusion and mechanical dispersion responsible for pollutant transfer through groundwater.	2×2
(b)	Suppose $1m^3$ of aquifer is contaminated with 50L 1,1 DCE. The aquifer has porosity of 0.5. Groundwater moves through it with an actual speed of 0.05m/day. The 1.1 DCE has a dissolved concentration equal to 15% of its aqueous solubility. The actual velocity of flow of ground water is 0.5m/d. Assume aqueous solubility of 1.1 DCE is 0.87g/100ml at 20°C and specific gravity 1.22 g/cc. Determine the retardation factor of DCE.	4
(c)	With neat labelled sketch establish the principle of Ghyben-Herzberg for salt water intrusion in unconfined aquifer.	5
(d)	Discuss two indicators to determine salt water intrusion in aquifer.	2
	Section-B (CO2)	
Q3. (a)	Explain in detail: (i) well loss, (ii) well interference and (iii) well efficiency	2×3
(b)	With a neat sketch of pattern of equipotential lines and flow lines determine the drawdown at a barrier boundary which is located at a distance 120m from a withdrawal well creating unsteady state of condition in and surround the well of diameter 50cm and pumping at a rate of 2000lpm. The transmissivity of the aquifer is $0.015m^2/s$.	2+4
Q4.	Determine graphically the aquifer parameters of a confined aquifer if the drawdown time data recorded at an observation well situated at a distance of 12.5 m from the pumping well of 30cm dia having rate of discharge of 1500 lpm are:	8

Time (min)	1.5	3	4.5	6	10	20	40	100
Drawdown (m)	0.15	0.6	1.0	1.4	2.4	3.7	5.1	6.9