Ref. No. **Ex/CE/PC/H/T/416/2024**

BACHELOR OF ENGINEERING IN CIVIL ENGINEERING EXAMINATION 2024

(Fourth Year, First Semester)

Water Resources Engineering III (Honors)

[WRE III (H)]

Time: Three Hours | Full Marks 100

Q No		***Attempt all Questions***		Marks
		Assume suitable values for the parameters if not supplied.		
1	(a)	Define 'Hydraulic Jump. What are the different depths in 'Hydraulic Jump'? What is the application of 'hydraulic jump'?	**CO1**	1+2+2=**5**
	(b)	What are the assumptions made in the momentum formula for 'Hydraulic Jump'? Discuss the effect of inclined bed, on the depth estimating equation of 'Hydraulic Jump', derived for horizontal bed. What would be the type of hydraulic jump in case of critical flow?	**CO2**	3+3+1=**7**
	(c)	Derive the expression of 'Initial Depth' of 'Hydraulic Jump', using momentum formula for horizontal bed.	**CO4**	**13**
2	(a)	What are the factors, which affect the design of spillway? What are the factors that affect the value of Coefficient of discharge? Explain briefly.	**CO2**	3+4=**7**
	(b)	What are the major components of spillway? Make a list of different types of spillway.	**CO2**	1+4=**5**
	(c)	An overflow ogee spillway of height 13m is discharging water with a head of 2 m over the crest. A reverse curvature of radius 4.5 m, subtending an angle of 60° at the centre, is provided at the spillway bottom. Assuming the discharge coefficient for the spillway as 2.2, determine the magnitude and direction of the dynamic force on the reversed curved portion of the spillway.	**CO3**	**13**
3	(a)	Define 'Freeboard' for Hydraulic Structures. Also define 'Fetch' and 'Effective Fetch'. How do you estimate 'Effective Fetch'? Explain Briefly.	**CO1**	2+3+5=**10**
	(b)	Compute 'Freeboard and the top elevation of the dam for the following details: Full reservoir level = 335.00m; Maximum water level = 337.20m Effective fetch: For normal freeboard = 3.66km & minimum freeboard = 4.00km Wind velocity over land for normal freeboard = 160km/hr Average depth of reservoir: For normal freeboard = 29.0m & minimum freeboard = 31.2m Embankment slope = 2.25(H):1(V) along with the following coefficients: • The upstream face surface roughness = 0.75 • The ratio of wind velocity over water surface to the wind velocity over land surface for effective fetch 2 and 4 as 1.16 and 1.24 respectively • Variation of the Relative Run-up (R/H_0) against Embankment Slope is as follows:	**CO2**	**15**
4	(a)	Design an aqueduct flumed section for a cross drainage work for the following given data: Canal Data: Discharge = 30.0 Cumecs Bed width = 20.0 m Depth of Water = 1.5 m Full Supply Level (FSL) = 251.50 m RL Drainage Data: High Flood Discharge = 250.0 Cumecs High Flood Level = 252.5 m RL High Flood Depth = 2.5 m General Ground Level 250.0 m Draw (on a graph sheet) the flumed section in plan and show the profile of Total Energy Level (TEL), Water Surface and Bed Level in elevation.	**CO4**	18+7=**25**

Embankment slope	0.1	0.2	0.3	0.4	0.5	0.6
Relative Run-up, R/H_0	0.368	0.752	1.200	1.600	1.968	2.272