Ref. No. Ex/CE/PE/B/T/422D/2023

BACHELOR OF ENGINEERING IN CIVIL ENGINEERING EXAMINATION 2023

(Fourth Year, Second Semester)

WATER RESOURCES ENGINEERING IIIE

Time: Three Hours **Full Marks: 100**

SL No		*Answer any **FIVE** questions. Assume suitable values for the parameters if not supplied*		Marks
1	(a)	What are the differences between wind-generated waves and tsunami waves?	CO1	4
	(b)	Discuss the probable effects of tsunami on coastal dynamics.		5
	(c)	Discuss the limiting condition for triggering tsunami due to submarine earthquake.		5
	(d)	The tsunami waves, having average wave height 25m and wave period 35minutes have arrived at the coast. The vegetated coastal land having average ground slope 1:80, could resist the run-up by 20%. Calculate the buffer distance from the coast to be evacuated.		6
2	(a)	What are the assumptions made in tide theory?	CO2	2
	(b)	What are the forces responsible for tide generation?		2
	(c)	Define 'Equilibrium tide' and 'Daily inequality in tide'.		3x2=6
	(d)	On the line joining Earth and Moon, A & B are diametrically opposite two points on the Earth's surface, on equator. Prove that the tide producing force at A & B would be same in magnitude but opposite in direction. Neglect the Sun's Gravitational attraction.		10
3	(a)	Define 'Freeboard' for coastal structures. Also define 'Fetch' and 'Effective Fetch'. How do you estimate 'Effective Fetch'? Explain Briefly.	CO3	2+3+3=8
	(b)	Compute 'Freeboard and the top elevation of the armored coastal structure having life of 20 years for the following details: Mean high tide level = 2.750m RL; Maximum high tide level = 3.270m RL Effective fetch: For normal freeboard = 10.0km & minimum freeboard = 13.0km Wind velocity over water for normal freeboard = 150km/hr & minimum freeboard 50km/hr U/s slope of the structure (V:H) = 1:6 (upper part) and 1:10 (lower part) 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 ≥ 10km is 1.31 • Variation of the Relative Run-up (R/H_0) against Embankment Slope is as follows:		12

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

Assume sea level rise 2.0mm per year and average settlement of said structure 30mm per 10 years

4	(a)	What is called wave motion? How many types of wave motions can be seen in the ocean? Explain briefly.										CO2	2+3=5
	(b)	Define: (i) Group wave celerity; (ii) Wave steepness; (iii) Significant wave height											3x1=3
	(c)	In a wave measurements programme, the wave height and period was measured at a water depth of 9.0m as follows:											12

Wave Height (m)	1.70	1.69	1.68	1.62	1.57	1.60	1.63	1.69	1.59	1.48	1.60	1.62
Wave period (sec)	12	11	11	12	10	10	10	11	10	9	10	11

Find the following:
(i) Significant wave height; (ii) Wave celerity and group wave celerity; (iii) Wave power and energy; (iv) Wave length; (v) Breaker height and length, if breaker depth is 2.0m.

5	(a)	What is Wave stiffness? What is the range of wave stiffness in case of wind generated waves?	CO1	1+2=3
	(b)	Two waves having same height, but different stiffness. Which of the two waves will travel faster?		3
	(c)	Discuss the motion of water particles, while transferring the energy in case of progressive wave.		3
	(d)	What are the expressions of wave speed in general, as well as, in deep water and shallow water as per surface wave theory?		3
	(e)	Discuss the assumptions made in surface wave theory.		6
	(f)	Express the group wave celerity in case of deep water and shallow water.		2
6	(a)	What are the basic data required for sediment budgeting of a coastal stretch? Explain briefly.	CO3	8
	(b)	In a coastal stretch, the average elevation of the sea beach was found to be 0.635m RL. Design a seawall in three layers for HTL=3.92m RL in that coastal stretch and wave height=1.34m. Provide a detail neat sketch of the designed section. Assume freeboard 2.5m and combined value of composite slope factor and friction factor 0.8. Also assume that the stability coefficient (KD) = 2.2 and layer coefficient ($K\Delta$) = 1.15. Given that Unit weight of armor material is 2700 kg/m3.		12