Ref. No. ***Ex/PG/CE/T/1210D/2024***

MASTER OF ENGINEERING IN CIVIL ENGINEERING EXAMINATION 2024

(First Year, Second Semester)

COASTAL AND OFFSHORE GEOTECHNOLOGY

Time: Three Hours

Full Marks: 100

PART I: 60 Marks
PART II: 40 Marks

Use a separate Answer-Script for each part

No. of questions		PART I (60 Marks)	Marks
		*Answer any **THREE** questions from this PART.* *Assume suitable values for the parameters if not supplied*	
1	(a)	What is littoral drift in ocean? What are the parameters on which littoral drift depends?	2+4=**6**
	(b)	Define: Point source and sink, Line source and sink, Littoral cell, Balanced littoral cell.	4x1=**4**
	(c)	Draw a schematic diagram of the coastal cell for its sediment budgeting.	**4**
	(d)	What are the steps involved for coastal sediment budgeting? Explain briefly.	**6**
2	(a)	What is littoral drift in ocean? What are the parameters on which littoral drift depends?	2+4=**6**
	(b)	Define: Point source and sink, Line source and sink, Littoral cell, Balanced littoral cell.	4x1=**4**
	(c)	Draw a schematic diagram of the coastal cell for its sediment budgeting.	**4**
	(d)	What are the steps involved for coastal sediment budgeting? Explain briefly.	**6**
3	(a)	What is called the artificial shore protection works? Give some examples, which are generally adopted? Explain briefly there functions with neat sketches.	2+6=**8**
	(b)	Design a seawall in three layers, having the cross sectional compound slope, at the lower end 1(V):12(H) and upper end 1(V):6(H), for HTL=3.25m RL and wave height=1.85m. Provide a detail sketch of the designed section. Assume minimum freeboard 2.0m and combined value of composite slope factor and friction factor 0.75.	**12**
4	(a)	What is called wave motion? How many types of wave motions can be seen in the ocean? Explain briefly.	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)	Define 'Freeboard' for coastal structures. Also define 'Fetch' and 'Effective Fetch'. How do you estimate 'Effective Fetch'? Explain Briefly.	2+3+3=**8**
	(b)	Compute 'Freeboard and the top elevation of the armoured 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

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M.E. CIVIL ENGINEERING FIRST YEAR SECOND SEMESTER – 2024
SUBJECT : COASTAL AND OFFSHORE GEOTECHNOLOGY (SMFE)

Time : 3 HOURS **Full Marks : 100**

PART II (40 Marks)

Use Separate Answer scripts for each PART
Assume reasonable values of data not supplied

1(a) What are the possible mechanism of over consolidation and incomplete mechanism of marine deposits. 4+4=8

(b) Write down the expressions for normalized undrained shear strength in terms of effective stress parameters, coefficient of earth pressure at rest, pore water pressure parameter, A, at failure for both normally consolidated and overconsolidated clay deposit and also other soil parameters. Discuss the purpose of using these expressions. 5+2=7

2. Using the following equation for pore pressure generation plot the increase in normalised undrained pore water pressure (u_N / σ_0') with normalised increase in number of load cycles (N/N_l) for a typical sandy deposit
$u_N / \sigma_0' = (2/\pi) \text{Sin}^{-1}(N/N_l)^{1/2\theta}$, where θ is a soil parameter, take, 0.70.
N_l = number of stress cycles to produce a pore water pressure ratio of 100% = 40
Prepare a Table of (u_N / σ_0') vs. (N/N_l) and plot the same. 7

3. Use the following equation to determine residual pore water pressure ratio (u_r / σ_c') for the soil parameters given below.
$u_r / \sigma_c' = \beta [\log (\gamma_c / (A_1 (OCR-1) + B_1))]$
Where, γ_c = single amplitude maximum cyclic shear strain = $\pm$ 1%
β= 0.45, OCR = 5, $A_1 = 0.4 \times 10^{-3}$, $B_1 = 0.6 \times 10^{-3}$
Use the above value of residual pore pressure ratio determine post cyclic shear strength (cohesion) of a soil deposit with initial cohesion of 50kPa. 4+4 = 8

4. Determine ultimate bearing capacity of a spud can foundation with the following data.
Cohesion = 25kPa
Diameter = 16m
Volume below seafloor = 570 cum
Depth of foundation = 4.0m
What will be the ultimate bearing capacity if eccentricity of foundation loading is 2m? 10