(**3 Hours**) Total Marks: 80

N. B. (1) Answer any **four** questions,

(2) Neat diagrams must be drawn wherever necessary

(3) Assume suitable data if required and state it clearly.

Qu. 1: a) Write a short note on scour depth. 4

b) Enlist the various shapes of well foundation and explain any two with neat sketch. 4

c) Explain Stress isobars. 4

d) Discuss various loads acting on marine structure. 4

e) Write the design consideration of under reamed pile foundation as per IS: 2911 (III). 4

Qu. 2: d) What is sharing of load in a pile group? Explain for the pile group subjected to axial and eccentric load about one axis 5

b) A precast concrete pile 30cmx30cm is driven by a single-acting steam hammer has a following data; i) Maximum rated Energy =3000 kN-cm, ii) Weight of hammer = 32.5kN, iii) Length of pile = 12m, iv) Efficiency of hammer=0.85, v) Coefficient of restitution =0.5, vi) Weight of pile cap= 5kN, vii) No. of blows for last 25.4mm =7 and viii) Modulus of elasticity of concrete= $2x10^7$ kN/m^2. Assume any other suitable data if required to calculate allowable load using; i) Engineering News Record Formula (FoS =4), ii) Hiley's Formula (FoS=4) and iii) Danish Formula (F0S=4). 15

Qu. 3: a) A circular well has an external diameter of 6.5m and sunk into sandy soil to a depth of 8m below the maximum scour depth. The resultant horizontal force is 1500 kN and the well is subjected to a moment of 15000 kN-m. Determine the safety of well against lateral force, assuming the well is i) rotate about a point above the base and ii) about the base. Assume γ' = 10kN/m^3, Φ = 30^0. Use Terzaghi's analysis and a safety 2.5 against passive resistance. 12

b) Discus the Meyerhof's bearing capacity theory. How does it differ from the Terzaghi's theory? 8

Qu. 4: a) A 500 mm diameter pile of length 15m was subjected to a pile load test. The test results are given in the table. Draw the graph and determine the allowable load. 10

Load (kN)	0	500	1000	1500	2000	2500
Settlement during loading (cm)	0	0.85	1.65	2.55	3.8	6.0
Settlement during unloading (cm)	4	4.6	5.2	5.5	5.8	6.0

b) Design a strip footing under series of three columns in a row placed at 3.5m c/c. The end and middle columns are subjected to an axial load of 800kN and 600kN respectively. The safe bearing capacity of soil is 180kN/m^2. Size of all end columns is 500mm x 500mm and 400mm x 400mm for intermediate. Assume M25 grade of concrete and Fe-415 grade steel. Show reinforcement details. 10

Qu. 5: a) Explain any five shapes of machine foundation with neat sketch. 5

b) A square footing 2 m side is laid at a depth of 1.5m below the ground surface. Design ultimate bearing capacity of footing if i) water table rises to level to the base, ii) water table rises to ground surface and iii) water table is at depth 1.0m below ground surface. Take γ_{sat} = 20kN/m^3, $\Phi = 35^0$, c= 6 kN/m^2, γ = 15kN/m^3, N_c = 30.14, N_q= 19.4 and N_γ = 42. 15

Qu. 6 a) Write design processes of Wharf. 5

b) Under which conditions pile foundation will be provided. 5

c) Explain; i) Dimension criteria, ii) Vibration criteria and iii) Displacement criteria, for designing a machine foundation. 5

d) Describe the various shear failures as per Vesic. 5
