Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

II SEMESTER M.TECH. (STRUCTURAL ENGINEERING)

END SEMESTER EXAMINATION

APRIL/MAY 2019

SUBJECT: OFFSHORE STRUCTURAL ENGINEERING [CIE-5259]

REVISED CREDIT SYSTEM

Time: 3 Hours Date: 29.04.2019 MAX. MARKS:

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.

Q.no		Marks	CO'S
1A	Explain the general steps considered in the design of an offshore structure.	02	CO1
1B	For water depth of 60m, wave of height 3.5m, and period 12sec. Determine the maximum horizontal velocity and acceleration of water at y=24m. Adopt Airy wave theory.	05	CO2
1C	Discuss the Effect of relative pile motion on calculation of force on pile due to waves.	03	CO2
2A	Write short note on Current loading on offshore structure.	03	CO2
2B	Determine the maximum wave force exerted by sea waves of height 4.0 m on the horizontal member of the structure as shown in Fig.Q2B All piles are 1.1 m meter diameter. Adopt C_D=1 and C_I=2. The depth of water is 35 m and wave length 105 m.	07	CO2
3A	Determine the effective axial stiffness of a 1.2 m diameter (external) pile having wall thickness of 12mm when the pile is driven 40 m in clay soil. Assume elastic modulus for clay, k_a = 800 kN/m^2. Also, determine the vertical deformation if the pile is subjected to vertical load of 20000kN.	04	CO3
3B	Determine the pressure induced stresses existing in a member at water depth of 55 m from still water level of an offshore structure. The member has an outside diameter of 1.0 m and a wall thickness of 20mm. Assume the ends of the member are fixed against displacement and rotation. Consider Poisson's ratio =0.25. Also calculate associated shear stress and plot variation of longitudinal and radial stresses across depth.	06	CO5
4	A steel member of an offshore structure, having yield stress of 250 MPa, wall thickness of 12 mm and radius 300 mm is subjected to net external pressure of 2MPa. Examine the hoop stress and design appropriate ring stiffeners if necessary spaced at 1.0m c/c to prevent buckling. Also, calculate and plot the variation of the maximum longitudinal and radial/hoop stress at the restrained ends if the Poisson's ratio is 0.3.	10	CO5
5A	Write stiffness matrix for any individual footing of diameter 20m having Shear modulus of 48000kN/m^2 and Poisson's ratio of 0.5. Also write stiffness matrix for footing arrangement in plan as shown in Fig. Q5A. each cell is of diameter 6.0m.	07	CO4
5B	What are the differences in behavior between free cylinders and restrained cylinders	03	CO5

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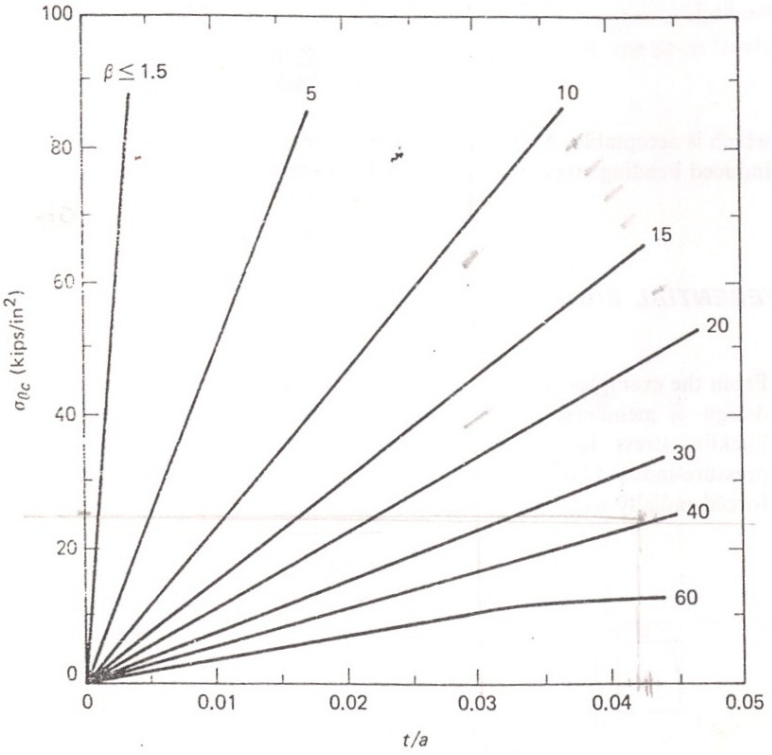
	when subjected to pressure induced loading?		



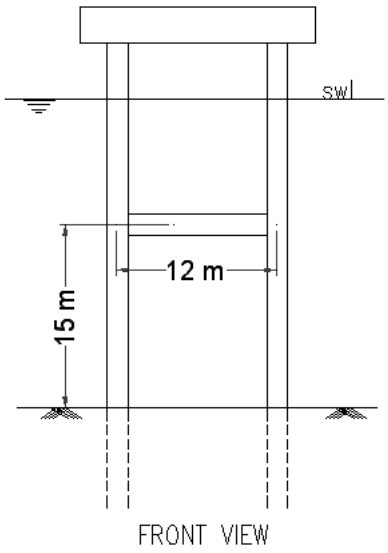


Fig. Q2B

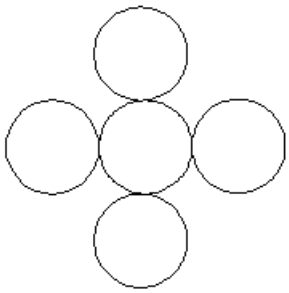


Fig.Q5A

Compressive Longitudinal Stress			Compressive Hoop Stress	
$\frac{\sigma_{zc}}{E}$	$\frac{S_a}{\sigma_Y}$	$\frac{S_t}{\sigma_Y}$	$\frac{\sigma_{\theta c}}{\sigma_Y}$	$\frac{S_\theta}{\sigma_Y}$
$\geq$0.010	0.60	0.67	$\geq$4.0	0.50
0.008	0.58	0.65	3.0	0.48
0.006	0.55	0.61	2.0	0.45
0.004	0.50	0.56	1.0	0.38
0.002	0.41	0.46	$\leq$0.5	$\frac{1}{2}\frac{\sigma_{\theta c}}{\sigma_Y}$