Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

II SEMESTER M.TECH. (STRUCTURAL ENGINEERING)
END SEMESTER EXAMINATIONS, APRIL/MAY 2017

SUBJECT: **OFFSHORE STRUCTURAL ENGINEERING [CIE 5259]**

REVISED CREDIT SYSTEM

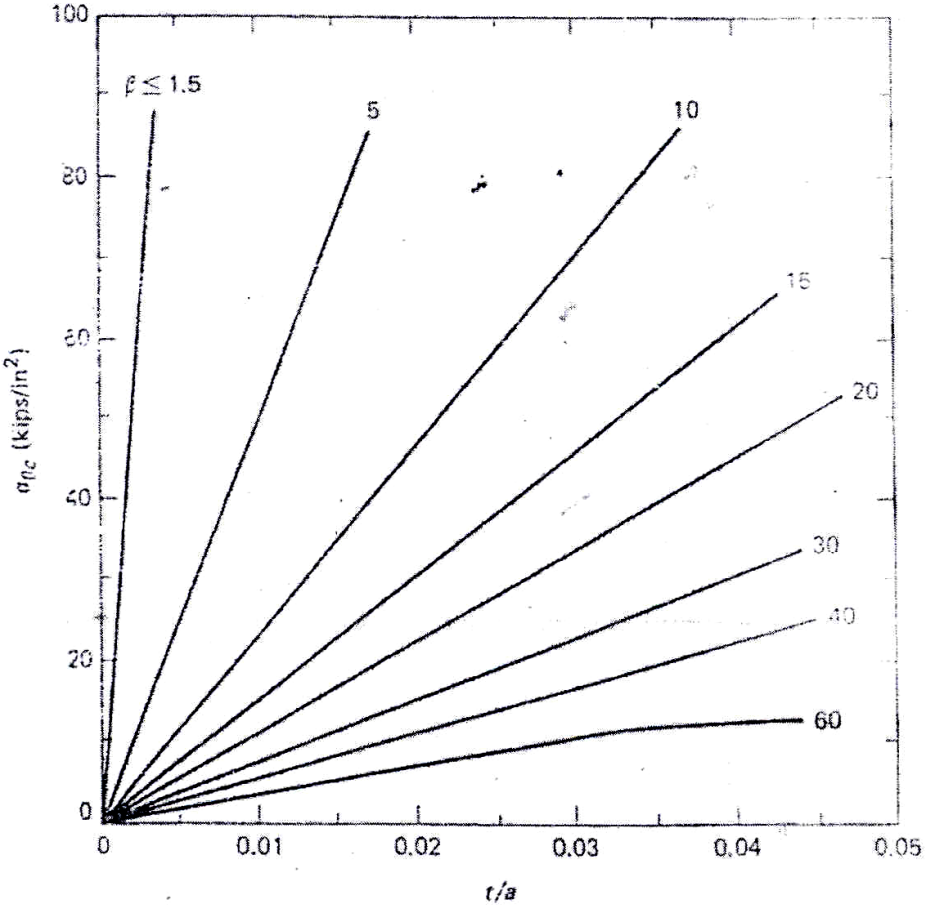
(25/04 /2017)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A.	Explain the general steps considered in the design of an offshore structure.	**06**
1B.	For water depth of 45m, wave of height 2.5m, and period 11sec. Determine the maximum horizontal velocity and acceleration of water under wave crest at y=24m. Adopt Airy wave theory.	**04**
2.	Determine the maximum horizontal wave force and its location for an inclined 30° pile in 45m depth of water. The pile is parallel to x-y plane. The wave height is 10m and wave length of 100m. The pile has a diameter of 1.6 m and pile length is 75m from the ground level. Adopt C_D =1.0 and C_I=2.0. Divide the pile into 2 segments.	**10**
3.	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**
4.	Clay soil deposit has undrained shear strength (cohesion) C, which varies linearly from zero at sea bed to 200kN/m^2/m at 200 m depth. Determine the depth L that a steel pile of 1.4 m outside diameter and 25 mm thick needs to be driven to carry an axial compressive load of 30,000 kN. Assume a factor of safety of 1.5. Consider the submerged weight of soil is 6.0kN/m^3 and that of steel 68.5kN/m^3 and Nc = 9.	**10**
5A.	Determine the effective axial stiffness of a 1.2 m diameter (external) pile having wall thickness of 12mm when the pile is driven 50 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 10000kN	**05**
5B.	Write short notes on ice loading, mud loading and buoyant forces on offshore structure with a neat sketch.	**05**



Compressive Longitudinal Stress			Compressive Hoop Stress	
$\frac{\sigma_{zc}}{E}$	$\frac{S_a}{\sigma_Y}$	$\frac{S_\varepsilon}{\sigma_Y}$	$\frac{\sigma_{\theta c}}{\sigma_Y}$	$\frac{S_\theta}{\sigma_Y}$
$\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	$\frac{1}{2}\frac{\sigma_{\theta c}}{\sigma_Y}$