Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL

(A constituent institution of MAHE, Manipal)

II SEMESTER M.TECH. (STRUCTURAL ENGINEERING)
END SEMESTER EXAMINATIONS, APRIL/MAY 2018

SUBJECT: OFFSHORE STRUCTURAL ENGINEERING [CIE 5259]
REVISED CREDIT SYSTEM

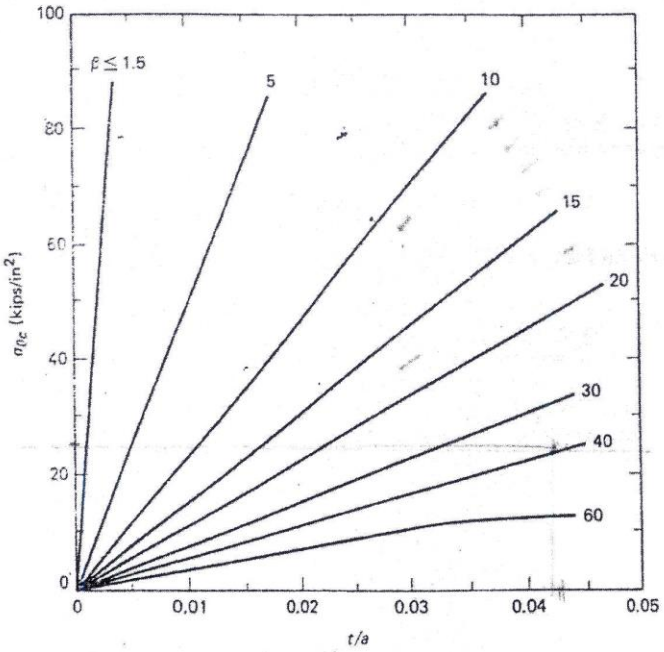
(/ 04/ 2018)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A.	Write short notes on current loading, wind loading and wave loading on offshore structure with a neat sketch.	**04**
1B.	For water depth of 45m, wave of height 2.0 m, and period 10sec. Determine the horizontal velocity and acceleration of water under wave crest at y = 25 m. Adopt Airy wave theory	**06**
2.	Determine the maximum force and moment at the base exerted, by sea waves and wind on vertical member 90m length having external diameter of 1.6m in a depth 40m of water. Adopt C_D =l.0, C_I =2.0, and C= 0.7. The wave height is 8m and wave length is 140 m at the site. The wind velocity is 240kmph at site and may be assumed act uniformly along the exposed length of vertical member. Adopt shape factor of 0.7.	**10**
3.	A steel member of an offshore structure, having yield stress of 240 MPa, wall thickness of 12 mm and radius 450 mm is subjected to net external pressure of 2.0MPa. Examine the hoop stress and design appropriate ring stiffeners if necessary spaced at 2.0m 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 Possion's ratio is 0.3	**10**
4.	A Sand deposit has submerged weight of 6.75kN/m^3. Determine the length of embedment of a steel pile 1.2m diameter, wall thickness 25mm to support an applied compressive load 10,000 kN. Assume a factor of safety of 2.5. Assume submerged weight of steel = 68.0 kN/m^3. Consider angle of friction = 30°, K =0.7, Nq = 40, f_{max} = 0.096MPa, q_{max} = 9.5MPa. Also calculate the length of embedment required if the applied load is tensile of same magnitude as above and give your comments.	**10**
5.	An offshore gravity structure consists of four concrete columns supporting a deck and equipment weighing 100,000kN. The inside and outside diameter of the each column is 8m and 6m, respectively. Assuming the columns un-flooded; determine the dynamic amplification factor for waves of 12-sec wave period. Calculations show that a total force of 4000kN acting at the deck level on the entire three-dimensional structure will cause a deck deflection of 25 mm. Take damping factor as 3%, S.W.L = 70m and deck level = 80m from the foundation level. Assume the deck acts as rigid diaphragm. Also discuss the static method of analysis on dynamic effects of wave forces.	**10**



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