	Reg. No.										
--	----------	--	--	--	--	--	--	--	--	--	--



Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

# KNOWLEDGE IS POWER

# II SEMESTER M.TECH (STRUCTURAL ENGINEERING) END SEMESTER EXAMINATIONS, MAY/JUNE 2016

## SUBJECT: OFFSHORE STRUCTURAL ENGINEERING [CIE 582]

### **REVISED CREDIT SYSTEM**

Time: 3 Hours

MAX. MARKS: 50

#### Instructions to Candidates:

✤ Answer ANY FIVE FULL the questions.

• Missing data may be suitable assumed.

1A.	Explain briefly different type of fixed offshore platforms with neat sketch.	07
1B.	Briefly explain the difference between design of offshore structure and land based structure.	03
2.	Determine the maximum force and moment at the base exerted by sea waves and wind on vertical member 50m length having external diameter of 1.5m in a depth 35 m of water. Adopt $C_D=1.0$ , $C_I=2.0$ and $C=0.7$ . The wave height is 6m and wave length is 150 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
3A.	Write short notes on punching shear failure and fatigue failure in offshore structure.	06
3B.	Explain the differences in behavior between free cylinders and restrained cylinders subjected to pressure induced loading.	04
4.	For a typical pile of an offshore structure having a diameter of 1.1m and wall thickness of 20 mm is driven to a depth of 100m. Cyclic wave forces on the overhead structure induce estimated lateral cyclic load at ground-line of 1200kN towards right and estimated cyclic moment of 2500kN-m clockwise. The soil consists of sand having angle of internal friction $=30^{\circ}$ , submerged density of the soil $=7.0 \text{ kN/m}^3$ , N=2 and k=9.5MPa. Determine the deflection and rotation of the pile at the ground-line.	10
5.	For an offshore concrete platform, the external diameter of the column is 4.5m and internal diameter is 3.5m. The deck and the equipment weight is 35000kN and the column weighs 9500kN. Assuming resultant wind and wave force on column and deck is 3000 kN to act at 25 m above the base of the column. Determine the net area of pre-stress tendon needed to prevent tensile stress in the concrete if the tendons are to be symmetrically placed. The tendons may be effectively pre-stressed to 1000MPa. Also calculate the diagonal tension associated with maximum shear stress and cracking moment. Assume concrete compressive strength of 40MPa.	10
6A.	Determine the effective axial stiffness of a 1.2 m diameter (external) pile having wall thickness of 12mm when the pile is driven 65 m in clay soil. Assume elastic modulus for clay, $k_a = 700 \text{ kN/m}^2$ . If the pile is loaded with 4000 kN vertical compressive load then what is vertical displacement.	05



(A Constituent Institute of Manipal University)

Manipal INSPIRED BY LIFE

6B.

Estimate the thickness of main leg of an offshore structure, if a diagonal member of 0.20 m radius and thickness 10 mm frames into it at an angle of 55° to vertical and exerts an axial compressive force of 1000kN and a moment of 750kN-m. Permissible shear yield stress of steel may be assumed as 125MPa.



05