INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR

DEPARTMENT OF OCEAN ENGINEERING AND NAVAL ARCHITECTURE

Date : 23.04.10 AN **Full Marks : 50**
End - Spring Semester 2009-20010 **Time : 3 Hrs.**
Subject Nos. : NA 40010 **B.Tech., Dual Degree B.Tech**
Subject Name : Offshore Technology
No.of students: 33
Instructions : Answer Any Six Questions

Q.1.a). Give the procedure for calculating wave force on fixed circular cylinder on the sea bed. (4)

b). Give the application of wave load regimes using the following parameters:

i. D – member diameter
ii. λ – wave length
iii. H – wave height (4)

Q.2.a). Discuss the application of the following *non-dimensional* quantities:

i. Keulegan Carpenter Number
ii. Reynold's Number
iii. Strouhal Number (3)

b). Find inertia force on caisson having diameter D = 7.3152 metres at a depth of 15.24 metres from water surface acted upon by a wave of length λ = 152.4metres and wave height, h_w = 6.096 metres. (5)

Q.3.a). With referene to linear wave theory give the expressions for velocity, acceleration of water particle and the dynamic pressure. (3)

b). Find water particle velocity, acceleration and dynamic pressure for the following wave having the particulars :

Water depth, d = 30.5 metres
Wave height, H = 6.0 metres
Time period, T = 10 secs. (3)

c). Discuss the types of non-linear waves encountered in the sea. (2)

Q.4.a). Discuss the types of offshore foundations encountered. (4)

b). Derive the expression for ultimate load carrying capacity for a single vertical pile

Q.5.a). What types of piles are to be found in offshore jacket platforms? (3)

b). Derive the expressions for the following items for a laterally loaded pile:

i. Deflection
ii. Slope
iii. Bending Moment
iv. Shear Force
v. Soil reaction (5)

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Q.6. Derive the expressions for depth of embedment *'D'* for a caisson (well foundation) in

i. Cohesionless soil (4)
ii. Cohesive soil (4)

Q.7.a). Discuss the various types of *buoys* and *mooring systems* used in offshore engineering. (4)

b). With the help of a free-body diagram of the element of a mooring line derive the expression for cable tension *'T'*. (4)

Q.8.a). Discuss the occurrence of 'Vortex Induced Vibration' in Marine Risers. Give the expression for its *equation of motion.* (4)

b). Derive the expression for *support motion* due to earthquake in a fixed offshore structure. (4)
