Ollscoil na hÉireann, Gaillimh
National University of Ireland, Galway
**SUMMER EXAMINATIONS, 2001**

**B.E. DEGREE**
**OFFSHORE & COASTAL ENGINEERING II**

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**Time allowed:** ***Two hours***

**Answer** ***three questions***

1.(a)Describe the three ways in which a steel jacket offshore platform is loaded out after fabrication on shore.

(b)Describe the tie-down procedure after loadout is complete.

(c)A design wave with a height of 10m and a period of 12 seconds in a depth of 26m acts on a pile with a diameter of 1.25m. Find the variation of the total force on the pile as a function of distance from the wave crest for $\theta = 0^0$; $20^0$; and $40^0$. Take $C_D = 0.7$ and $C_M = 1.5$.

2.(a)A design wave with height of 6m and period of 11 seconds acts on a cylinder with a diameter of 1.1m in water of depth 28m. The cylinder is oblique and makes an angle of $50^0$ with the vertical axis. Its projection on the horizontal plane makes an angle of $40^0$ with the direction of wave propagation. The cylinder has a length of 15m. The upstream end of the cylinder is 4m above the seabed, and the downstream end is higher than the upstream end. (If we take the waves as propagating in the $+x$ direction, then "upstream" refers to $-\infty$ and "downstream" refers to $+\infty$.).
Find the ***inertia*** force on the cylinder when the crest in 30m from the upstream end. Include sketches with dimensions. Take one segment only when subdividing the cylinder. $C_M = 1.5$.

(b) Derive an expression which relates the weight per linear metre mooring chain in air to its weight in water.

3.(a) A surface float is moored with a chain whose submerged weight is 36.48N/m. The depth is 44.2m and the drag on the float is 1000N. What should be the minimum length of chain if the allowable maximum angle of the mooring line with the horizontal is $30^0$ at the anchor? What is then the tension at the anchor and at the buoy? What is the excursion of the buoy downstream?

(b) A pulp log floats on its long side, but a slice of this log floats on its flat side. Both are cylinders with the same diameter, d, and density, $\rho_B$; yet the stable position of each depends on its aspect ratio, that is, on the ratio of its height, h, to the diameter, d. Prove that the critical aspect ratio $(h/d)_c$ for which a small displacement of the cylinder, from its "axis vertical"position will result in a change to the horizontal and stable

position, is given by

$$\left(\frac{h}{d}\right)_c = \frac{0.354}{\sqrt{(\rho_B/\rho)(1-\rho_B/\rho)}}$$

where $\rho$ is the density of water and, of course, $\rho_\beta < \rho$ .

(c)Write notes on the floating production system known as the tension leg platform.

4.(a) Classify hydrocarbon reservoirs on the basis of structure.

(b) Describe fully the technique of rotary drilling.

(c)When exploratory wells are drilled at sea, the procedure is more complicated than it is on land where the surface provides a base for the drilling rig. Describe four of the drilling structures used in offshore operations.