Max Marks: 25 (Time Limit: 1 Hr)

26/03/2018

APL105 – MECHANICS OF SOLIDS AND FLUIDS
Minor 2

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Entry #: 2016TT10860

Question 1 (4 Marks): A child holds a string tied to a balloon in his hand while sitting in a car, which accelerates forward at 2m/s². Find the angle made by the balloon with the vertical. State clearly whether the balloon tilts forward or back. Hint: The balloon can move along a pressure gradient, and the balloon has negligible mass.

Question 2 (6 Marks): The gate of width b of a dam has weight W, and has dimensions as shown. It is hinged at O. Find the height h of the water at the left of the gate at which the gate starts opening. Note that the gate is of uniform thickness, so that the weight acts at $L/2$ from the end of the gate.
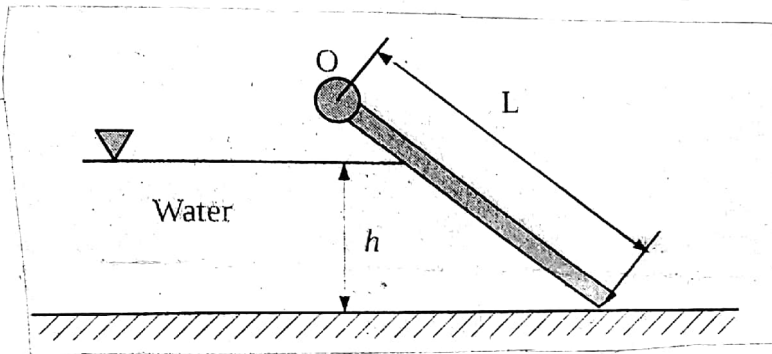

Question 3 (8 Marks): The 48-kg collar G is released from rest in the position shown and is stopped by plate BDF that is attached to the 20-mm-diameter steel rod CD and to the 15-mm-diameter steel rods AB and EF. Knowing that for the grade of steel used σ_{all} = 180 MPa and E = 200 GPa, determine the largest allowable distance h. [Ref. Fig 2]

Question 4 (7 Marks): The assembly ABC is made of a steel for which E = 200 GPa and σ_Y = 320 MPa. Knowing that a strain energy of 5J must be acquired by the assembly as the axial load **P** is applied, determine the factor of safety with respect to permanent deformation when (a) x = 300 mm, (b) x = 600 mm. [Ref. Fig 3]
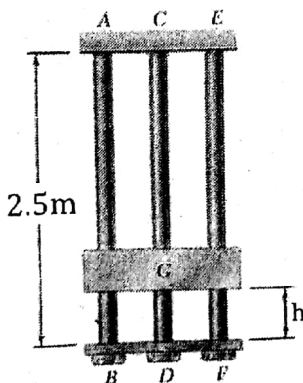
[Fig 2]
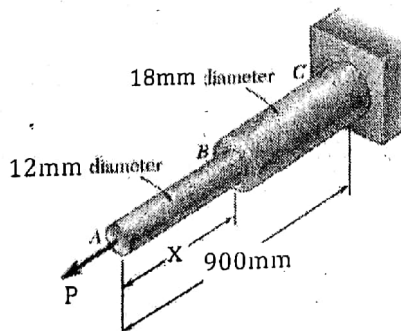
[Fig 3]

NOTE: IF you think something is missing, please feel free to assume the data. But do not forget to clearly mention your assumption/s.