| INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR |
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| **Instructor: Prof Mohammad Saud Afzal** |
| **Department of Civil Engineering** |
| Course: CE21003 |
| **Submission Deadline: Not to be submitted** |
| **Total Marks: NA** |

Fluid Statics

Q1)   A manometer is used to measure the pressure in a tank. The fluid used has a specific gravity of 0.85, and the manometer column height is 55 cm, as shown in Fig. If the local atmospheric pressure is 96 kPa, determine the absolute pressure within the tank.

$P_{atm} = 96$ kPa

$P = ?$

$h = 55$ cm

$SG = 0.85$
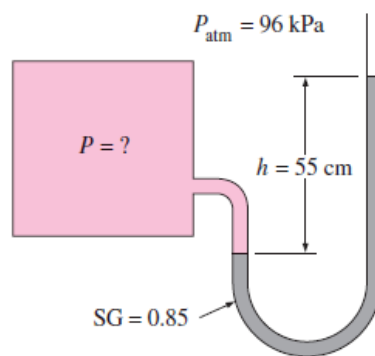
Q2)   The water in a tank is pressurized by air, and the pressure is measured by a multifluid manometer as shown in Fig. The tank is located on a mountain at an altitude of 1400 m where the atmospheric pressure is 85.6 kPa. Determine the air pressure in the tank if $h_1 = 0.1$ m, $h_2 = 0.2$ m, and $h_3 = 0.35$ m. Take the densities of water, oil, and mercury to be 1000 kg/m³, 850 kg/m³, and 13,600 kg/m³, respectively.
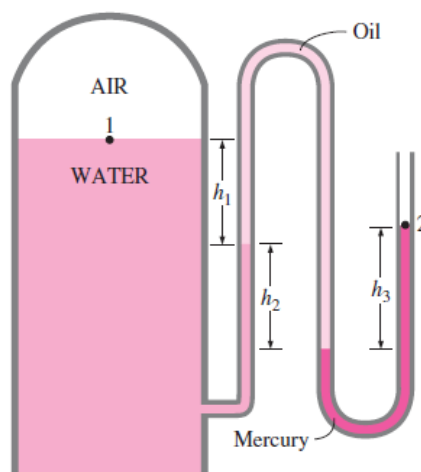
Q3) A rectangular plane surface 2 m wide and 3 m deep lies in water in such a way that its plane makes an angle of 30° with the free surface of water. Determine the total pressure and position of centre of pressure when the upper edge is 1.5 m below the free water surface.

Q4) A long solid cylinder of radius 0.8 m hinged at point A is used as an automatic gate, as shown in Fig. When the water level reaches 5 m, the gate opens by turning about the hinge at point A. Determine (a) the hydrostatic force acting on the cylinder and its line of action when the gate opens and (b) the weight of the cylinder per m length of the cylinder.
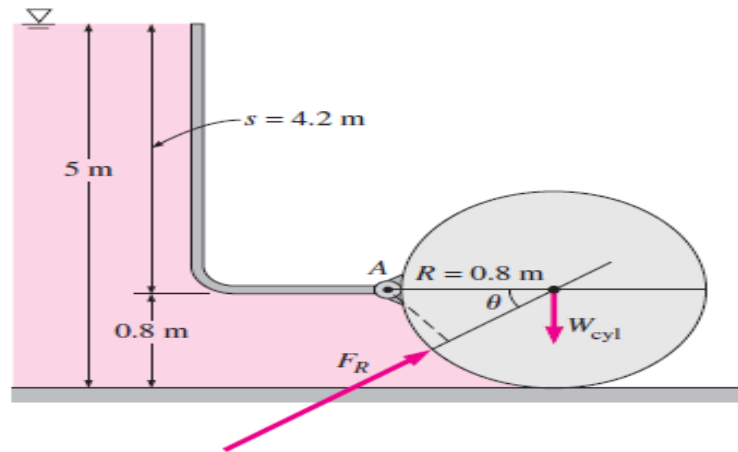
Q5) A crane is used to lower weights into the sea (density=1025 kg/m³) for an underwater construction project. Determine the tension in the rope of the crane due to a rectangular 0.4 m * 0.4 m * 3 m concrete block (density _ 2300 kg/m³) when it is (a) suspended in the air and (b) completely immersed in water.