

Q.1

A Tank contains water up to a height of 300mm above the base. An immiscible liquid of specific gravity 0.9 is filled above the water up to height of 600 mm. determine (i) pressure at the bottom of the tank (ii) the position of center of pressure on the side of the tank. Take width of tank is 2m

Given

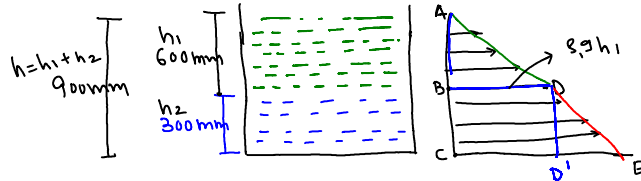
$$\rho_1 = 0.9 \times 1000 = 900 \text{ kg/m}^3$$

$$\rho_2 = 1000 = 1000 \text{ kg/m}^3$$

$$\text{width of tank} = 2 \text{ m}$$

$$h_1 = 600 \text{ mm} = 0.6 \text{ m}$$

$$h_2 = 300 \text{ mm} = 0.3 \text{ m}$$

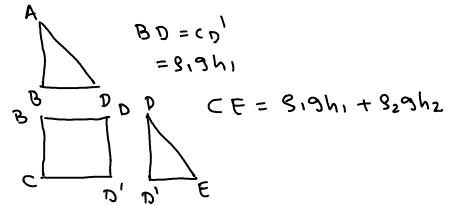


Pressure at Point B

$$= \rho_1 g h_1 = 900 \times 9.81 \times 0.6 = 5297.40 \text{ N/m}^2$$

Pressure at Point C

$$= \rho_1 g h_1 + \rho_2 g h_2 = 900 \times 9.81 \times 0.6 + 1000 \times 9.81 \times 0.3 = 8240.4 \text{ N/m}^2$$



Total Pressure force

$$= \text{area of } ACE$$

$$= \text{area of } \triangle ABD + \text{area of } \square BDD'C + \text{area of } \triangle DD'E$$

$$= \frac{1}{2} \times AB \times BD + BC \times CD + \frac{1}{2} \times DD' \times D'E$$

$$= \frac{1}{2} \times 0.6 \times 5297.40 + 0.3 \times 5297.40 + \frac{1}{2} \times 0.3 \times (8240.4 - 5297.40)$$

$$= 1589.22 + 1589.22 + 441.45$$

$$= 3619.89 \text{ N/width}$$

$$F = 3619.89 \times 2 \text{ M}$$

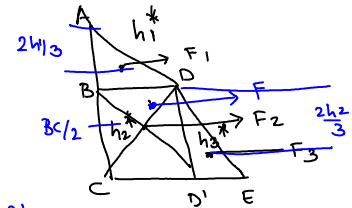
$$= 7239.78 \text{ N}$$

$$h_1^* = \frac{2 \times 0.6}{3}$$

$$h_2^* = 0.6 + \frac{0.3}{2}$$

$$h_3^* = h_1 + \frac{2h_2}{3}$$

$$= 0.6 + \frac{2 \times 0.3}{3}$$



Taking moment about Point A

$$F \times h^* = F_1 \times h_1^* + F_2 \times h_2^* + F_3 \times h_3^*$$

$$7239.78 \times h^* = 3178.4 \times \frac{2 \times 0.6}{3}$$

$$+ 3178.4 \times \left(0.6 + \frac{0.3}{2}\right)$$

$$+ 882.9 \times \left(0.6 + \frac{2 \times 0.3}{3}\right)$$

$$h^* = 0.6024 \text{ m} \rightarrow \text{free surface of liquid}$$