College of Engineering & Technology

Department: Mechanical Engineering   Marks: 10
Lecturer: Dr. Rola Afify   Time: 3:30 – 4:10
Course Code: ME362   Date: 25/3/2015

Name: Model Answer   R. N.:

Answer the following questions:
Question one (5 marks)
A) If a certain liquid has a specific weight of 8600 N/m^3, what are the values of its density, specific volume, and specific gravity?

QI
A) $\quad w = 8600 \ N/m^3 \ = \rho g$

$\therefore$ density $\rho = \dfrac{8600}{9.8} = 877.55 \ kg/m^3$

$\therefore$ sp. volume $v = \dfrac{1}{\rho} = 1.14 \times 10^{-3} \ m^3/kg$

$\therefore$ sp. gravity $\gamma = \dfrac{\rho_f}{\rho_w} = \dfrac{877.55}{1000} = 0.88$

B) A flat plate 200 mm x 750 mm slides on oil (μ = 0.85 Ns/m^2) over a large plane surface. What force (F) is required to drag the plate at a velocity (v) of 1.2 m/s, if the thickness (t) of the separating oil film is 0.6 mm?
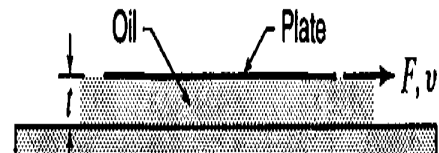

B) $\quad A = 200 \times 750 \times 10^{-6} = 0.15 \ m^2$

$\quad \mu = 0.85 \ N \cdot s/m^2$

$\quad V = 1.2 \ m/s \qquad dy = t = 0.6 \times 10^{-3} \ m$

$F = \mu A \dfrac{du}{dy}$

$\quad = 0.85 \times 0.15 \times \dfrac{1.2}{0.6 \times 10^{-3}} = 255 \ Newton$

A) Explain using neat sketches Pascal law.

$P_I = P_{II}$

$$\frac{F_1}{A_1} = \frac{F_2}{A_2}$$

$$F_2 = F_1 \left(\frac{A_2}{A_1}\right)$$
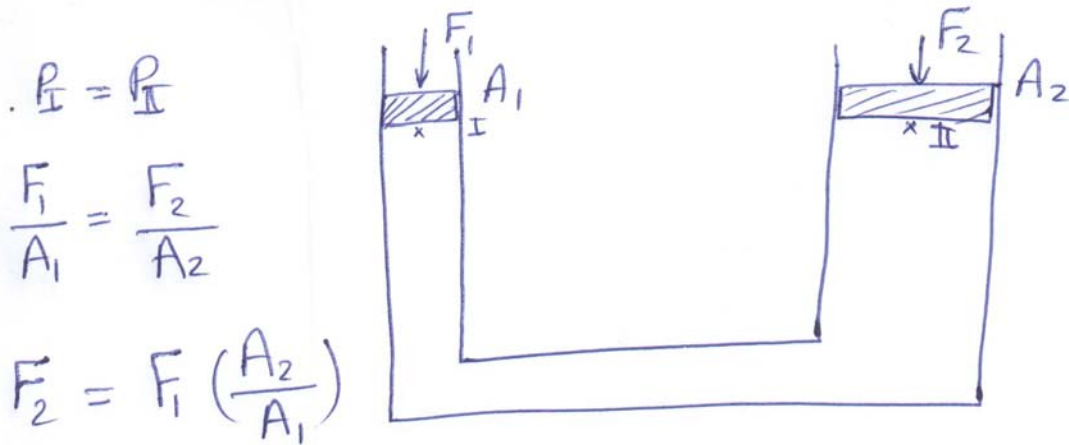
B) A U-tube mercury manometer is connected to a closed pressurized tank, as shown in figure. If the air pressure is 138 KPa, determine the differential reading, h. The specific weight of the air is negligible.

Pair = 138 KPa

air

Water

Mercury S.G.=13.6
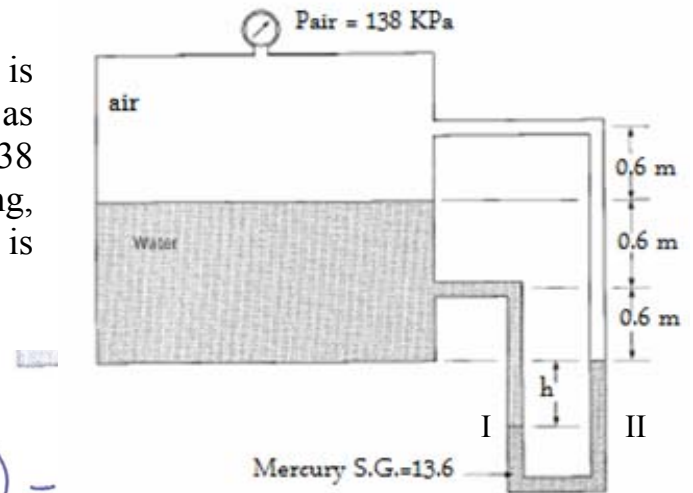
$P_I = P_{II}$

$P_{air} + \rho_w g (0.6 + 0.6 + h) = P_{air} + \rho_m g h$

$\rho_w g (0.6 + 0.6) = \rho_m g h - \rho_w g h$

$1000 * 9.8 * 1.2 = (13600 - 1000) * 9.8 * h$

$h = \dfrac{1000 * 1.2}{12600}$

$= \dfrac{2}{21} = 0.095 \, m$