MET 330 HW 1 WEEK 1 8/30/22

1.48) GIVEN: $F = 18{,}000\ lb$
$d = 2.5\ in$
CYLINDER, $A = \frac{\pi}{4}D^2$

SOLUTION: 1. $P = F/A \rightarrow P = \frac{F}{\frac{\pi}{4}D^2}$

2. $\frac{F}{\frac{\pi}{4}D^2} \rightarrow \frac{18{,}000\ lb}{\frac{\pi}{4}(2.5)^2} \boxed{= 3{,}666.93\ \frac{lb}{in^2}}$

1.58) GIVEN: USING BULK MODULUS,

$E_m = 3{,}590{,}000\ psi,\ 24{,}750\ MPa$

SOLUTION: $\Delta P = -E[\Delta V/V]$

1. $\Delta P = -3{,}590{,}000\ psi(-1/100)$
$\boxed{= 35{,}900\ psi}$

2. $\Delta P = -24{,}750\ \frac{MPa}{psi}(-1/100)$
$\boxed{= 247.5\ MPa}$

1.63) GIVEN: $d = 0.50\ in, R = 0.25$
$L = 42\ in$
MACHINE OIL
$E = 189{,}000\ \frac{lb}{in^2}$

STIFFNESS FORMULA $\rightarrow K_A = \frac{E \cdot A}{L}$

SOLUTION: COMPUTE STIFFNESS OF ACTUATOR IN lb/in

$\cancel{E = \frac{-\Delta P}{\Delta V/V}}$ DON'T USE

$\frac{\frac{lb}{in^2}\ in^2}{in} = \frac{lb}{in}$

1. $K_A = \frac{E \cdot A}{L} = \frac{E \cdot \pi R^2}{L}$?

$\rightarrow \cancel{189{,}000\frac{lb}{in^2} \cdot \left(\frac{\pi}{4}(0.5in)^2\right) \cdot 42in}$

$\rightarrow \frac{\left(189{,}000\ \frac{lb}{in^2}\right) \cdot \left(\pi(0.25)^2_{in}\right)}{42\ in}$

$\rightarrow \boxed{K_A = 883.57\ lb/in}$

1.76) GIVEN: 1 lbf, COMPUTE MASS IN SLUGS, Kg, N (WEIGHT)

SOLUTION: 1. $\frac{1\ lbf}{32.2\frac{ft}{s^2}} \rightarrow 0.031\ \frac{lbf \cdot s^2}{ft}$ OR $\boxed{0.031\ SLUG}$

2. $1\ lbf \rightarrow \frac{1\ lbf}{2.205} = \boxed{0.4535\ kg}$

3. $1\ lbf \rightarrow 1\ lbf \cdot 4.4482\ N = \boxed{4.4482\ N}$

1.92) GIVEN: CYLINDER W/ OIL
$D = 150\ mm \rightarrow 0.15m$
$w_1 = 2.25\ N$
$W_2 = 35.4N$
$h = 200\ mm \rightarrow 0.2m$

SOLUTION: FIND sg_{oil}
$sg = \frac{\rho}{\rho}$

1. $W_{oil} = W_2 - W_1$
$= 35.4 - 2.25\ N$
$= 33.15\ N$

2. $m_{oil} = \frac{W}{g} \rightarrow \frac{33.15N}{9.81\frac{m}{s^2}} = 3.379\ Kg$

3. $V_{oil} = A \cdot h \rightarrow \frac{\pi}{4}D^2 \cdot h \rightarrow \frac{\pi}{4}(0.15m)^2 \cdot (.2m) = 0.00353\ m^3$

4. $\rho_{oil} = \frac{M_{oil}}{V_{oil}} \rightarrow \frac{3.379\ Kg}{0.00353\ m^3} = 957.22\ Kg/m^3$

5. $sg_{oil} = \frac{\rho_{oil}}{\rho_{water}} \rightarrow \frac{957.22\ \cancel{Kg/m^3}}{1000\ \cancel{Kg/m^3}} = \boxed{0.957}$

1.107) GIVEN: $sg_{ALCOHOL} = 0.79$, CALCULATE DENSITY IN SLUGS/ft^3, g/cm^3

SOLUTION: 1. $sg_A = \frac{\rho_A}{\rho_{WATER}} \longrightarrow \rho_A = sg_A \cdot \rho_{WATER}$

2. $\rho_A = 0.79 \cdot 1\ g/cm^3 = \boxed{0.79\ g/cm^3}$

3. $0.79 \frac{g}{cm^3} \cdot \frac{1\ slug}{14590\ g} \cdot \frac{2.54\ cm}{1\ in} \cdot \frac{2.54\ cm}{1\ in} \cdot \frac{2.54\ cm}{1\ in} \cdot \frac{12\ in}{1\ ft} \cdot \frac{12\ in}{1\ ft} \cdot \frac{12\ in}{1\ ft} = 1.533$

$$\boxed{= 1.533\ \frac{slug}{ft^3}}$$