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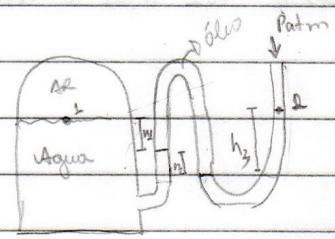
Lista 02 Mecânica dos fluidos

~~3.8~~, ~~3.21~~, ~~3.29~~, ~~3.34~~, ~~3.58~~, ~~3.61~~, ~~3.63~~, ~~3.118~~, ~~3.120~~, ~~3.123~~. ~~3.56~~

3.8.



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$h_1 = 0,2$, $\rho_{água} = 1000\ kg/m^3$

$h_2 = 0,3$ $\rho_{óleo} = 850\ kg/m^3$

$h_3 = 0,46$ $\rho_{Mercúrio} = 13600\ kg/m^3$

$P_{man} = P_{abs} - P_{atm}$

Pmanométrica do ar $P_{man} = P_1 - P_2$

$P_1 + P_{H_2O} + P_{óleo} - P_{Hg} = P_2$ ... P_{man}

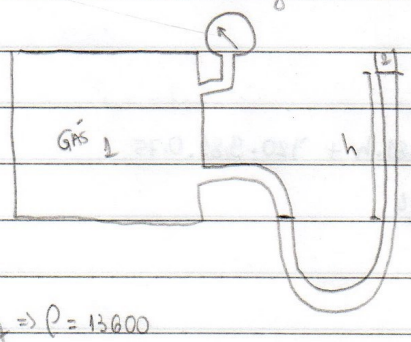
$P_{man} = -1000 \cdot 9,81 \cdot 0,2 - 850 \cdot 9,81 \cdot 0,3 + 13600 \cdot 9,81 \cdot 0,46$

$P_{man} = -1962 - 2501,55 + 61371,36$

$P_{man} = +56.907,81$

3.21

$P_g = 80\ kPa$



$P_1 - \rho g h = P_2$

$\underbrace{P_1 - P_2}_{P_{man}} = \rho g h$

$Hg \Rightarrow \rho = 13600$

a) $80000 = 13600 \cdot 9,81 \cdot h$

$\Rightarrow h = \frac{80000}{13600 \cdot 9,81} = 0,5996\ m$

b) $H_2O \Rightarrow \rho = 1000$

$\Rightarrow h = \frac{80000}{1000 \cdot 9,81} = 8,154\ 9$

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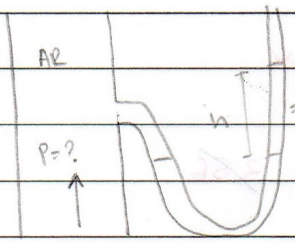
3.24



$\rho = 13.600 \cdot Kg/m^3$

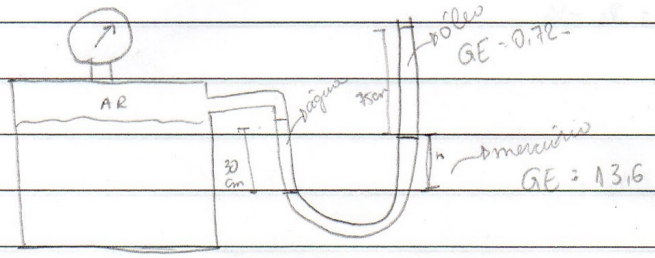
$P_{atm} = 100\,KPa$

a) Como a pressão no duto é = 102 KPa é maior que a atm.

b) $P_{man} = P_{abs} - P_{atm} \Rightarrow P_{abs} = P_{man} + P_{atm}$

$P_{abs} = 2 + 100 = 102\,KPa$

3.34 $GE \cdot \rho_{H2O} = \rho$



$P_{man} = 4,5\,KPa$ $\quad P_{man} = P_{abs} - atm$

$P_{ar} + P_{água} - P_{mg} - P_{óleo} = P_{atm}$

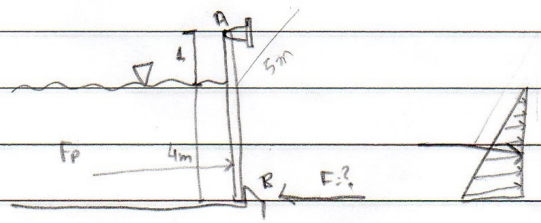
$P_{ar} - P_{atm} = -P_{água} + P_{mg} + P_{óleo}$

$P_{man} = -1000 \cdot 9,81 \cdot 0,3 + 13600 \cdot 9,81 \cdot h + 720 \cdot 9,81 \cdot 0,75$

$45000 = -2943 + 133416h + 5297,4$

$h = \frac{48645,6}{133416} = 0,3196\,m$

3.56



h=4m Sempre h_c.

$P_{H2O} = \rho g h = 1000 \cdot 9,81 \cdot \frac{4}{2}$

$P = 19.620\,Pa$

$F = P.A = 19620 \cdot 20 = 392,4\,KN$

$y_P = \frac{1}{3} \cdot h = \frac{2}{3} \cdot 4 = 2,66$

$\Sigma M_A = 0 \Rightarrow F_R \cdot s - F_B \cdot L = 0$

$392,4 \cdot 3,66 - F_B \cdot 5 = 0$

$F_B = \frac{1436,18}{5} = 287,24\,KN.$

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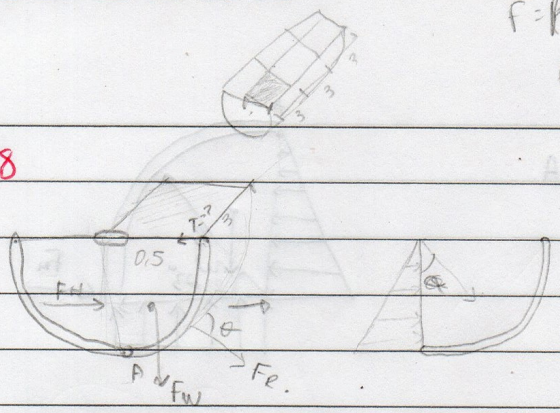
$F = P \cdot A$ $\quad \frac{\pi R^2}{4}$ $\quad \frac{\pi R^2}{4}$ ○ $\quad$ __/__/__

$\rho g h \cdot \frac{\pi \cdot R^2}{4}$ $\quad F = P \cdot A$

3.58



$F_H = F_x = \rho g \frac{h}{2} \cdot A$

$F_V = F_y + W.$

$F_R = \sqrt{F_H^2 + F_V^2}$

$tg\ \alpha = \frac{F_V}{F_H}$

$R = 0{,}5\,m$

$F_H = P \cdot A = \rho \cdot g \cdot h_c \cdot A = 1000 \cdot 9{,}81 \cdot \frac{0{,}5}{2} \cdot (3 \cdot 0{,}5) = 3678{,}75\ N.$

$F_V = W = \rho \cdot g V \Rightarrow 1000\ 9{,}81 \cdot \left(3 \cdot \frac{\pi \cdot 0{,}5^2}{4}\right) \Rightarrow F_V = 5778{,}56\ N.$

$F_R = \sqrt{F_H^2 + f_V^2} = \sqrt{3678{,}75^2 + 5778{,}56^2} = 6850{,}17\ N.$

$tg^{-1} = \frac{F_V}{F_H} = \frac{5778{,}66}{3678{,}75} = 57{,}5°$

$\Sigma M_A = 0 = -F_R \cdot \cos\theta \cdot R + T \cdot R = 0$

$T = F_R \cdot \cos\theta$

$T = 3680{,}59.$

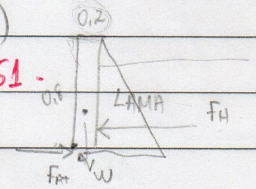
$F_{at} = m \cdot g \cdot \mu$

$\rho = \frac{m}{V}$ $\quad F_N = m \cdot g$

$m = \rho \cdot V$

a)

3.61 -



$\Rightarrow F_{at} = F_H$

$m \cdot g \cdot \mu = \rho_{lama} \cdot g \cdot \frac{h}{2} \cdot A$

$\rho \cdot V \cdot g \cdot \mu = \rho_{lama} \cdot g \cdot \frac{h}{2} \cdot A$

$\rho_{conc} = 2700$

$\rho_{Lama} = 1800$

$\mu = 0{,}3$

$\mu \cdot \rho_{conc} \cdot g \cdot (0{,}8 \cdot 0{,}2 \cdot 1) = \rho_{lama} \cdot g \cdot \frac{h}{2} \cdot h \cdot 1$

$\mu \cdot \rho_{conc} \cdot g \cdot (0{,}8 \cdot 0{,}2) = \rho_{lama} \cdot g \cdot \frac{h^2}{2}$

$2700 \cdot 0{,}8 \cdot 0{,}2 \cdot 0{,}3 = 1800 \cdot \frac{h^2}{2}$

$129{,}6 = 900 h^2$

$h = \sqrt{\frac{129{,}6}{900}} = 0{,}3794\ m.$

b) $F = P \cdot A$ (lama)

$F = \rho \cdot g \cdot \frac{h}{2} \cdot A$

$F = \rho \cdot g \cdot \frac{h}{2} \cdot h \cdot 1$

$F = \rho \cdot g \cdot \frac{h^2}{2}$ (lama)

$\Sigma M_A = 0 \quad -F_W \cdot L_2 + F_H \cdot L_2 = 0$

$-\rho_{conc} \cdot g \cdot V \cdot 0{,}1 + \rho_{lama} \cdot g \cdot \frac{h^2}{2} \cdot \frac{h}{3}$

$-\rho_{conc} \cdot g \cdot V \cdot 0{,}1 = \rho_{lama} \cdot g \cdot \frac{h^3}{6} = 0$

$2700 \cdot 0{,}8 \cdot 0{,}2 \cdot 1 \cdot 0{,}1 = 1800 \cdot \frac{h^3}{6}$

$h = \sqrt[3]{43{,}2 / 300} = 0{,}5241\ m.$

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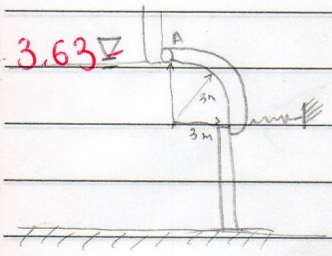
3.63 ▽

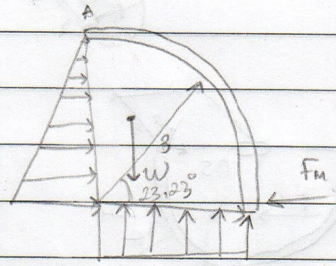


$F_H = F_x = \rho g \frac{h}{2} \cdot A$

$F_V = F_y + W$

$F_R = \sqrt{F_H^2 + F_V^2}$

$tg\theta = \frac{F_V}{F_H}$



$F_H = F_x = \rho . g . \frac{h}{2} . A$

$F_H = 1000 . 9,81 . \frac{3}{2} . (3.4) =$ 176580N ou 176,58 KN.

$F_y = \rho . g . h_{fundo} . A =$

$1000 . 9,81 . 3 . 3.4 = 353\,160$ N ou 353,160KN

$W = \rho . g . V = \rho . g . \left(\frac{\pi . r^2}{4}\right) h =$

$W = 1000 . 9,81 . \frac{\pi . 3^2}{4} . 4 = 277\,371,21$ ou 277,371 KN.

$F_V = F_y - W = 353\,160 - 277\,371,21 =$ 75 788,79 N

$F_R = \sqrt{176580^2 + 75788,79^2} =$ 192 157,32 N.

$tg^{-1}\left(\frac{75\,788,79}{176.580}\right) = 23,23°$

P/ encontrar F na mola temos

$\Sigma M_A = 0 \quad F_R . \cos 22,23° . R - F_M . R = 0$

$F_R . \cos 22,23° = F_M$

$F_M = 192\,157,32$ N. $\cos 22,23°$

$F_M = 177.874,77$ N ou 177,87KN.

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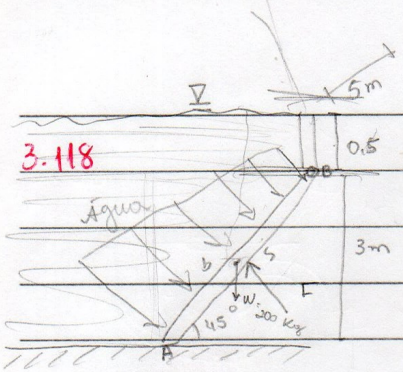
3.118



Força hidrostática. $b_{1ma} = \frac{3}{\text{sen}45} \Rightarrow 4,24$

$F = P_{med} \cdot A$

$F = \rho \cdot g \cdot h_c \cdot A = 1000 \cdot 9,81 \cdot (0,5 + \frac{3}{2}) \cdot (4,24 \cdot 5)$

$F = 415\,942\ N \Rightarrow 416\ KN.$

Altura do centro de pressão: $b = 4,24$, $s = \frac{0,5}{\text{sen}45} = 0,7071$

$y_p = s + \frac{b}{2} + \frac{b^2}{12(s + \frac{b}{2})} = 0,7071 + \frac{4,24}{2} + \frac{4,24^2}{12(0,7071 + \frac{4,24}{2})} = 3,36$

distância até a dobradiça

$L_D = y_p - s = 3,36 - 0,7071 = 2,652$

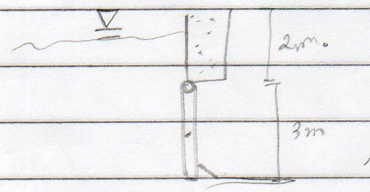
Encontrando F

$\Sigma M_B = 0 \quad F_R \cdot y_p - F \cdot \frac{b}{2} = 0$

$F = \frac{F_R \cdot y_p \cdot 2}{b} = \frac{416\ KN \cdot 2,652 \cdot 2}{4,24} = 520,39\ KN.$

$F = \rho \cdot g \cdot h_c \cdot A$

3.120.



Força hidrostática

$F = P \cdot A$ onde $h_c = (s + \frac{b}{2})$

$F = \rho g h_c A$

$F = 1000 \cdot 9,81 \cdot 3,5 \cdot (3,6)$

$F = 618\ KN.$

Altura do centro de pressão.

$y_p = s + \frac{b}{2} + \frac{b^2}{12(s + b/2)}$

$y_p = 2 + \frac{3}{2} + \frac{3^2}{12(2 + \frac{3}{2})} = 3,71\ m$

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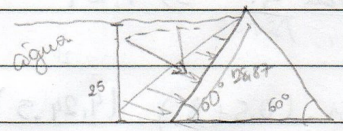
$P_{atm} = 100 kPa$

3.123 -



Largura = 15m

a) $F_{total} = F_h + F_{atm}$

b)

a) $\text{sen}\,60 = \frac{25}{b} \Rightarrow b = \frac{25}{\text{sen}\,60} = 28,87\,m.$

$F_R = P_{total} \cdot Área \Rightarrow F_R = (F_{fluido} + F_{atm}) \cdot A$

$F_R = (\rho g h_c + F_{atm}) \cdot A$

$F_R = \left(\left(1000 \cdot 9,81 \cdot \frac{25}{2}\right) + 100.000\right) \cdot (28,87 \cdot 150) = 964\,077\,562,5\,N$ ou $964,1\,MPa$

$y_p = s_1 \frac{b}{2} + \frac{b^2}{12(s + b/2 + \frac{p_0}{\rho \cdot g \cdot \text{sen}\,\theta})} \Rightarrow 0 + \frac{28,87}{2} + \frac{28,87^2}{12\left(\frac{0 + 28,87}{2} + \frac{100000}{1000 \cdot 9,81 \cdot \text{sen}\,60°}\right)}$

$y_p = 17,1\,m$

a componente horizontal é igual

$F_h = 964\,077\,562,5 \cdot \text{sen}\,60° = 834\,915\,666,34\,N$ ou $834,91\,MPa$

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