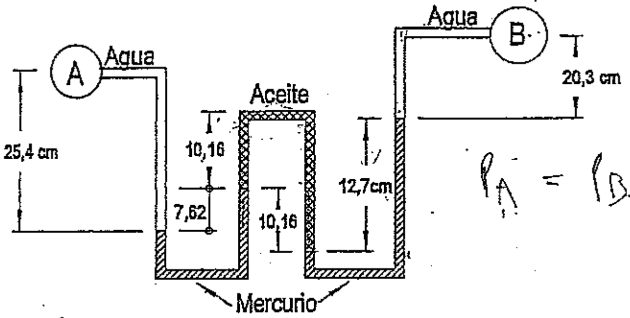
4/28

PARTE PRÁCTICA

Problema 1:

Para el manómetro de la figura con aceite de densidad relativa 0,8, mercurio de densidad relativa 13,6 y agua de densidad relativa 1, calcular la diferencia de presiones entre los puntos A y B. Las medidas están en centímetros.

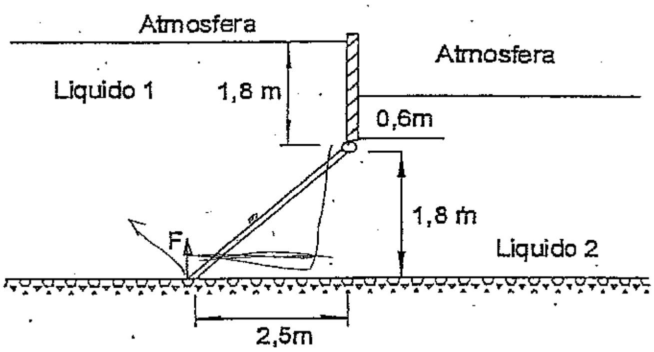


$P_A = P_B + 12{,}7\gamma - 10{,}16\gamma_{ac} +$

Problema 2:

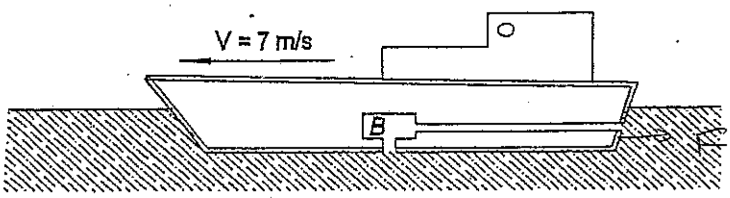
Encontrar la magnitud de las fuerzas de cada lado de la compuerta rectangular de 1,5 m de ancho. Encontrar el centro de presión de las fuerzas de cada lado de la misma Determinar la fuerza F necesaria para que la compuerta pueda abrirse, la compuerta 1500 Kg. M. de Inercia del rectángulo = $b.h^3/12$

Datos: Líquido$_1$ $\gamma_1 = 1000$ kg/m^3 - Líquido$_2$: $\gamma_2 = 800$ kg/m^3



Problema 3: (entra?)

Un barco es propulsado a 7 m/s mediante una bomba que toma agua del centro del barco. La descarga en la popa se hace mediante un conducto de 15 cm de diámetro con un caudal de 0,4 m^3/s ¿Qué fuerza de propulsión ~~se~~ ejercerá ~~sobre~~ el barco sobre el agua? ¿Cuál será la potencia puesta en juego para esta propulsión?



$$\rightarrow \boxed{\psi(x,y) = \frac{y^2}{2} - \frac{x^2}{2} + 2xy}$$

Otra forma

$$\frac{\partial \psi}{\partial y} = y + 2x \longrightarrow \psi(x,y) = \frac{y^2}{2} + 2xy + f(x)$$

$$\frac{\partial \psi}{\partial x} = 2y + f'(x) = -x + 2y \; ; \; f'(x) = -x$$

$$f(x) = -\frac{x^2}{2} + C$$

b) $\bar{V} = (u, v) = (y + 2x \, ; \, x - 2y)$

$V(1,2) = (2 + 2 \, ; \, 1 - 4) = (4, -3)$

$\|V\| = \sqrt{16 + 9} = \boxed{5}$ $\quad P(1,2)$

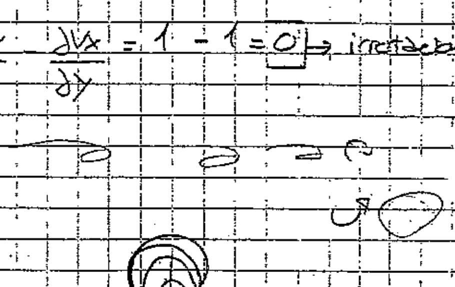
c) Permanentes

Compresibilidad ($div(\bar{V}) = 0 \rightarrow$ incompresible)

$div(v) = \frac{\partial V_x}{\partial x} + \frac{\partial V_y}{\partial y} = 2 - 2 = \boxed{0} \rightarrow$ incompresible

Rotor:

$$rot(\bar{V}) = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ V_x & V_y & 0 \end{vmatrix} = \frac{\partial V_y}{\partial x} - \frac{\partial V_x}{\partial y} = 1 - 1 = \boxed{0} \rightarrow \text{irrotacional} \; \therefore \; \text{laminar}$$



Parcial Mecánica de Fluidos (30/9/09)

Parte Teórica:

Problema 1:

$$\boxed{\begin{aligned} u &= \frac{\partial \phi}{\partial x} = \frac{\partial \psi}{\partial y} \\ v &= \frac{\partial \phi}{\partial y} = -\frac{\partial \psi}{\partial x} \end{aligned}}$$

Cond. Cauchy-Schwartz

(ϕ potencial y ψ corriente)

$\phi = xy + x^2 - y^2$

Potencial $\longrightarrow$ Componentes Campo $\vec{V}=(u, v)$ $\longrightarrow$ Corriente

$$u = \frac{\partial \phi}{\partial x} = \frac{\partial(xy + x^2 - y^2)}{\partial x} = \boxed{y + 2x}$$

$$v = \frac{\partial \phi}{\partial y} = \frac{\partial(xy + x^2 - y^2)}{\partial y} = \boxed{x - 2y}$$

$$u = \frac{\partial \psi}{\partial y}$$

$$\partial \psi = u \cdot \partial y = \int (y + 2x)\, dy = \frac{y^2}{2} + 2xy + C_1 \; f(x)$$

$$\psi_x = \frac{y^2}{2} + 2xy + f(x)$$

$$v = -\frac{\partial \psi}{\partial x}$$

$$\partial \psi = -\partial x \cdot v = -\int x - 2y \, dx = -\frac{x^2}{2} + 2yx + C_2 \; f(y)$$

$$\psi_y = -\frac{x^2}{2} + 2yx + f(y) \Longrightarrow f(y) = \frac{y^2}{2} \text{ y } f(x) = -\frac{x^2}{2}$$

Problema 2:

a) $\vec{V} = 4xy^2 \hat{i} + f(y)\hat{j} - zy^2 \hat{k}$

$$\boxed{div(\vec{V}) = 0 \,,\; \frac{\partial U}{\partial x} + \frac{\partial V}{\partial y} = 0}$$ Ec. dif. continuidad

$$div(\vec{V}) = \frac{\partial (u)}{\partial x} + \frac{\partial (v)}{\partial y} + \frac{\partial (w)}{\partial z} = 4y^2 + f'(y) - y^2$$

$div(\vec{V}) = 0$ (Porque cumple continuidad)

$4y^2 + f'(y) - y^2 = 0$

$f'(y) = y^2 - 4y^2 = -3y^2$

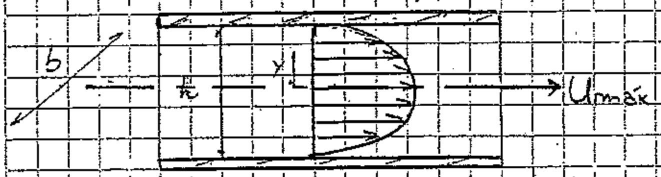
$$\boxed{f(y) = -y^3 + f(x,z)}$$

b)

[illegible]

Problema 3

μ, b



$$u(y) = 4 \cdot U_{máx} \cdot \left[\frac{y}{h} - \left(\frac{y}{h} \right)^2 \right]$$

$$F = \tau \cdot A = \mu \cdot \frac{du(y)}{dy} \cdot A = \mu \left\{ 4 U_{máx} \left(1/h - 2 (y/h)(1/h) \right) \right\} \cdot \frac{\pi (h)^2}{4}$$

$$F = \mu \cdot \cancel{4} \, U_{máx} \left(\frac{1}{h} - \frac{2y}{h^2} \right) \cdot \frac{\pi (h)^2}{\cancel{4}}$$

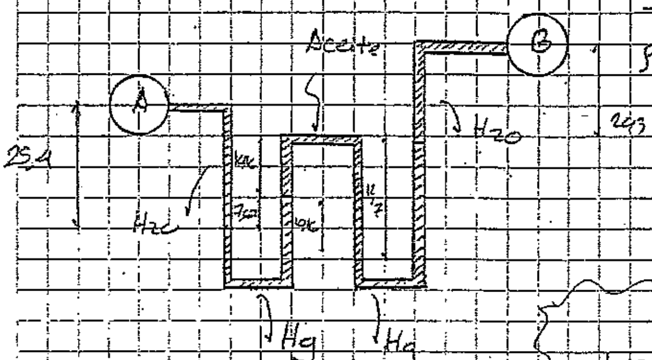
$$\boxed{F_\tau = \mu \cdot \pi \cdot U_{máx} \cdot h \left(1 - \frac{2y}{h} \right)}$$

Parte Práctica

Problema 1:

$\rho_{oil} = 0,8$

$\rho_{Hg} = 13,6$



hiciste cualquiera! y tenés q igualar alturas!

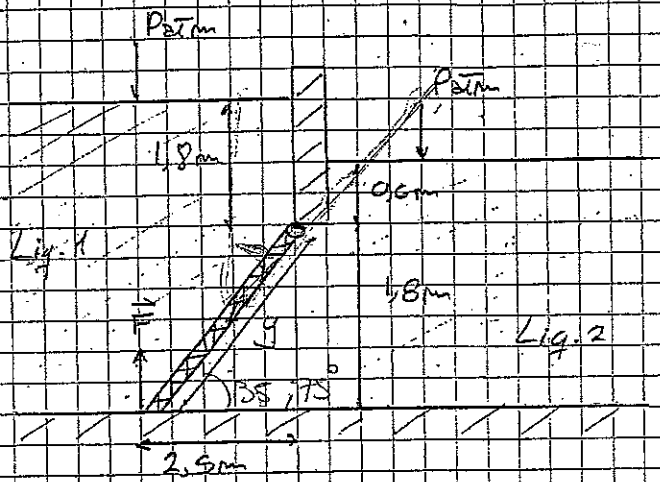
$\downarrow \oplus$ $\uparrow \ominus$

$$P_A - P_B = -\rho_{H_2O}\, g\, (0,254\,m) + \rho_{Hg}\, g\, (0,0762\,m) - \rho_{oil}\, g\, (0,1016\,m) + \rho_{Hg}\, g\, (0,127\,m) + \rho_{H_2O}\, g\, (0,203\,m)$$

$$\Delta P_{AB} = P_A - P_B = -(1000\,kg/m^3)(9,8\,m/s^2)(0,254\,m) + (13600\,kg/m^3)(9,8\,m/s^2)(0,0762\,m) - (800\,kg/m^3)(9,8\,m/s^2)(0,1016\,m) + (13600\,kg/m^3)(9,8\,m/s^2)(0,127\,m) + (1000\,kg/m^3)(9,8\,m/s^2)(0,203\,m)$$

$$\boxed{\Delta P_{AB} = P_A - P_B = 25,8\,kPa}$$

Problema 2:



$l = 1,5m$

$m = 1500kg$

$I_c = \frac{bh^3}{12}$

$\delta_1 = 1000\, kg/m^3\ (\rho_1)$

$\delta_2 = 800\, kg/m^3\ (\rho_2)$

Liq. 1: (no tengo en cuenta $\vec{P}_{atm}$ ya que actúa en ambos lados de la pieza, ∴ se anulan entre sí)

$F_B = \rho_1\, g\, h_c\, A = (1000\,kg/m^3)(9,8\,m/s^2)(1,8m + 0,9m)(l \times y)$

$y = \sqrt{(1,8m)^2 + (2,5m)^2} = 3,08m$

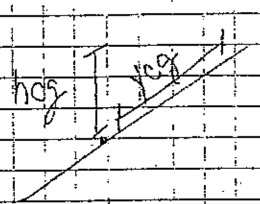
$F_{B1} = (1000\,kg/m^3)(9,8\,m/s^2)(2,7m)(1,5m \times 3,08m)$

$\boxed{F_{B1} = 122,25\,kN = 12474\,kgf}$

$y_{P1} = y_c + \frac{I_c}{y_c\, A} = (2,7m) + \frac{l \times y^3}{12(2,7m)(1,5m \times 3,08m)} =$

NO el $h_{cg} \neq y_{cg}$!!

$= (2,7m) + \frac{(1,5m)(3,08m)^3}{12(2,7m)(1,5m \cdot 3,08m)}$



$\boxed{y_{P1} = 3m}$

Entonces:

$\sum M_A = 0$

$$F \cdot Y \operatorname{Sen}(\alpha) - F1 \operatorname{Cos}(\alpha)\, Y_1 + F2 \cdot \operatorname{Cos}(\alpha) \cdot Y_2 - mg \operatorname{Cos}(\theta) = 0$$

$$F = \frac{mg \operatorname{Cos}(\theta) + F1 \operatorname{Cos}(\alpha) Y_1 - F2 \cdot \operatorname{Cos}(\alpha) Y_2}{Y \operatorname{Sen}(\alpha)}$$

$$F = \frac{(1500\,kg)(9{,}8\,m/s^2) \cdot \operatorname{Cos}(35{,}75) + (122{,}25\,kN) \cdot \operatorname{Cos}(54{,}25) \cdot (2{,}05\,m) - (59{,}33\,kN) \cdot \operatorname{Cos}(54{,}25) \cdot (0{,}394\,m)}{(3{,}08\,m) \cdot \operatorname{Sen}(54{,}25)}$$

$$\boxed{\bar{F} = 58{,}35\,kN = 5954\,kgf}$$

Fig 2

$F_{R2} = \rho_2 \cdot g \cdot h_c \cdot A = (800\,kg/m^3)(9{,}8\,m/s^2)(0{,}6m + 0{,}9m)(1{,}5m \times 3{,}08m)$

$$\boxed{F_{R2} = 54{,}33\ kN = 5544\ kgf}$$

$$y_{P2} = y_c + \frac{I_c}{y_c\, A} = (0{,}6m + 0{,}9m) + \frac{(1{,}5m)(3{,}08m)^3}{12(0{,}6m + 0{,}9m)(1{,}5m)(3{,}08m)}$$

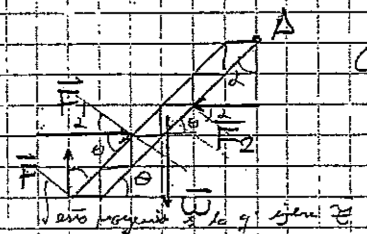
$$\boxed{y_{P2} = 2{,}03\,m}$$

b)

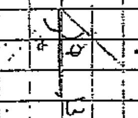
$\curvearrowright (+)$

$tg(\theta) = \frac{OP}{A_d} = \frac{1{,}8}{2{,}5}$

$\theta = 35{,}75° \rightarrow \alpha = 54$.



Quiero hallar $\vec{F}$



$\Sigma M_A = 0$ (justo antes de ocurrir, cuando se rompe el equilibrio)

$F \cdot Y \cdot Sen(\alpha) - F_1 \cdot Cos(\alpha) \cdot Y_1 + F_2 \cdot Cos(\alpha) \cdot Y_2 - W \cdot Cos(\theta) = 0$

$Cos(\alpha) = \frac{ad}{H} = \frac{(Y_{P1} - 1{,}8m)}{Y_1}$

$$Y_1 = \frac{(3m - 1{,}8m)}{Cos(54{,}25)} = 2{,}05m$$

$Y_2 \Rightarrow Cos(\alpha) = \frac{ad}{Y_2} = \frac{(Y_{P2} - 1{,}8)}{Y_2}$

$$Y_2 = \frac{(2{,}03m - 1{,}8m)}{Cos(54{,}25)} = 0{,}394\,m$$