Sheet 1 - INTRODUCTION

1- $a = 8.5\ m/s^2$

2- S.G. = 2.94 *Metric System*
S.V. = $0.001\ cm^3/Dyne$

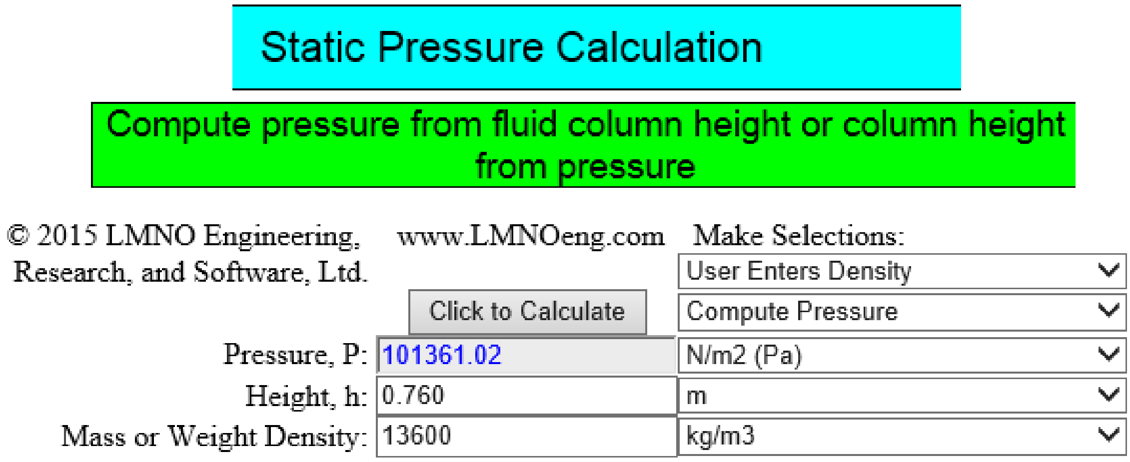
3- $\rho = 740.1\ kg/m^3$ *S.I. System*
S.G. = 0.74

4- $\mu = 0.04$ Pa.s *S.I. system*

5- $(dv / dy) = 19.23\ rad.s^{-1}$
$\tau = 0.923$ Pa
$\nu = 5.257x10^{-5}\ m^2/sec$

Sheet 2 - STATICS OF FLUIDS

1- $P = 101396.16\ N/m^2$



2- $P = 1048\ kg/m^2$

& $h = 1.048$ m of water

3- $P = 7000\ kg/m^2$

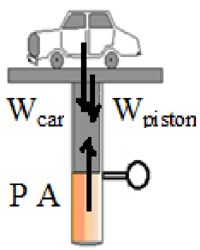
OR $h = 7$ m of water

4- $h = 31.4$ cm

5- $P_A - P_B = 9880\ kg/m^2$

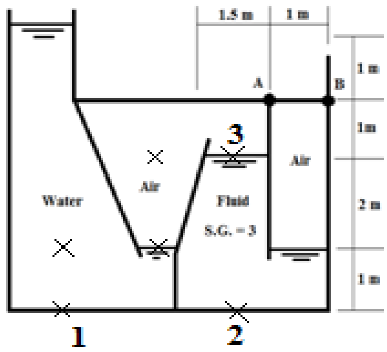
6- $P_B = 0.977\ kg/cm^2$

7- $W_{car} = 14080\ N = 1435.3\ kg = 1.44\ t$



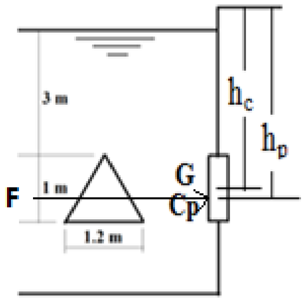
8- Max pressure will occur at point (2).

F_{AB} = 98100 N

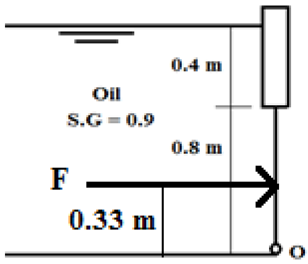


9- F = 1 * 3.67 * 0.6 = 2.2 t

h_p = 3.69 m



10- M = 0.23 t.m

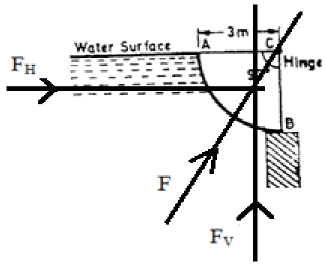


11- F_H = 4.5 t

F_V = 7.07 t

$\therefore$ F = 8.38 t

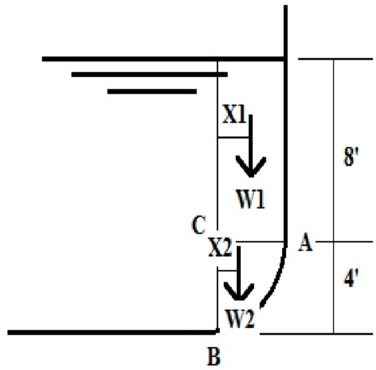
$\alpha = \tan^{-1}(1.57) = 57^{o}\ 30'$



12-

$\therefore$ F_H = 62.4 * 10 * 24 = 14976 lb

$$h_p = \frac{(32 \sin^2 90)}{10 * (4*6)} + 10 = 10.13 \text{ ft}$$

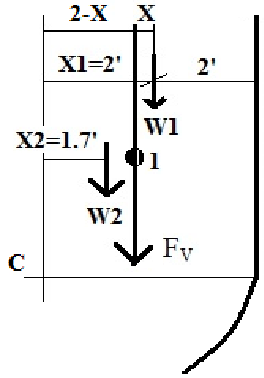


The vertical force F_V:

W_1 = 11980.8 lb

$W_2 = 62.4*(0.25*\pi(4)^2*6) = 4704.85$ lb lb

$\therefore F_V = W1 + W2 = 11980.8 + 4704.8 = 16685.6$ lb



To get location of F_v:

$M_1 = 0$

$x_2 = 4\ r / 3\ \pi = 1.7$ ft

$W_1*x = W_2*(0.3 – x)$ $\therefore$ x = 0.08 ft

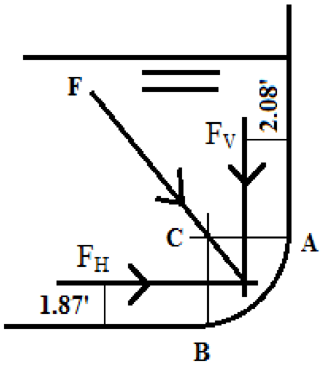
$\therefore$ F_V acts vertically downward at 2.08 ft from the tank edge

The total force F:

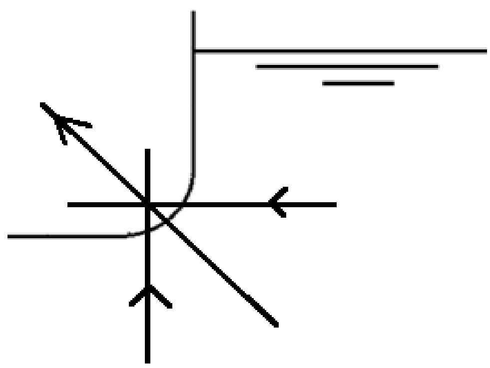
$F = (F_H^2 + F_V^2)^{1/2} = (14976^2 + 16685.6^2)^{1/2} = 22421$ lb

$\tan \alpha = F_V / F_H = 16685.6 / 14976 = 1.11$

$\alpha = \tan^{-1}(1.11) = 48.1°$



13-



14- (a) $V_{displaced}$ = 1.52 m3

(b) Centre of Buoyancy (B) = 0.38/2 = 0.19 m from the base

Centre of Gravity (G) = 0.5/2 = 0.25 m from the base

$\therefore$ B is below G

The block may be stable or unstable. The metacentre M has to be calculated.

If M is above G, the block will be stable.

If M is below G, the block will be unstable.

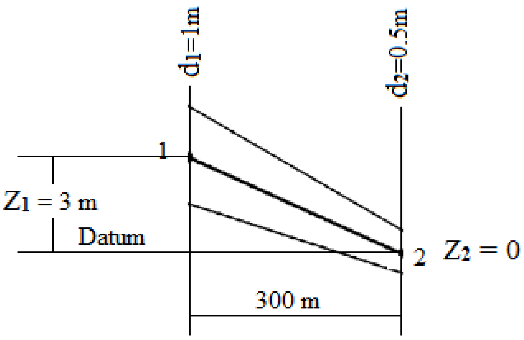
Sheet 4

DYNAMICS OF FLUID FLOW

1- $v_1 = 22.5$ m/s

$v^2/2g = 25.8$ m

$Q = 0.044\ m^3/sec$



2- $P_2 = 72.9903\ t/m^2$

$P_2 = 72.9903/10 = 7.3\ kg/cm^2$

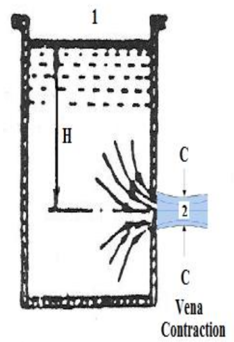
3- $h_m = 29.5$ cm

5- $d_2 = 4.4$ cm

The reading of a differential mercury manometer is 60 cm.

Sheet 5

FLOW THROUGH AN ORIFICE



1- (a) $Q_R = C_d\ Q_I = 0.62x(178857.3) = 110891.5\ cm^3/sec$

(b) $v_R = C_v\ v_I = 0.9 \times (1328.83) = 1322.2$ cm/sec

2- The fall of water = 4 – 2.3 = 1.7 m

T = 379.1 sec

Sheet 6

MOMENTUM EQUATION

1- $F_x = 0 - \rho\ (\pi\ D^2/4)\ u^2 = 70.75$ N

$F_y = 0$

2- $F_x = -\ 200.\ 01$ N

Thus the required holding force is 200.01 N in + x direction.

In y – direction:

There are no forces due to momentum change or pressure. $\therefore F_Y = 0$

Sheet 7

FLOW THROUGH PIPES

1- (a) Q = 0.034 m^3/sec

2- Q = 0.042 m^3/sec

3-

1. Moody chart:

k/d = $0.05\text{x}10^{-3}$ / 0.06 = 0.0011 & Re $\therefore$ from chart, f = 0.0065

$$h_f = \frac{4\ f\ L\ v^2}{2\ g\ d} = \frac{4\text{x}0.0065\text{x}1\text{x}(0.796)2}{2\text{x}9.81\text{x}0.04} = 0.0209 \text{ m / m of pipe}$$

2. Smooth pipe i.e. Blasius equation:

$F = 0.079 / R_e^{0.25} = 0.079 / (31840) = 0.0059$

$$h_f = \frac{4\ f\ L\ v^2}{2\ g\ d} = \frac{4\text{x}0.0059\text{x}1\text{x}(0.796)2}{2\text{x}9.81\text{x}0.04} = 0.02 \text{ m / m of pipe}$$

4- $v_C = 1.27$ m/s

$P_B = -\ 41.11$ kN/m^2

5- $v_3 = 7.67$ m/s

$Q = v_3 \times A = 7.67 \times (\pi\ (0.09)^2/4) = 0.049$ m^3/s

P_{2abs} = 58.88 kPa

6- (a) $P_F = 0$

(b) P_A and P_B

(c) The decreased pressure energy at B is converted to velocity energy.

(d) The pressure at C is the lowest due to the highest position energy.

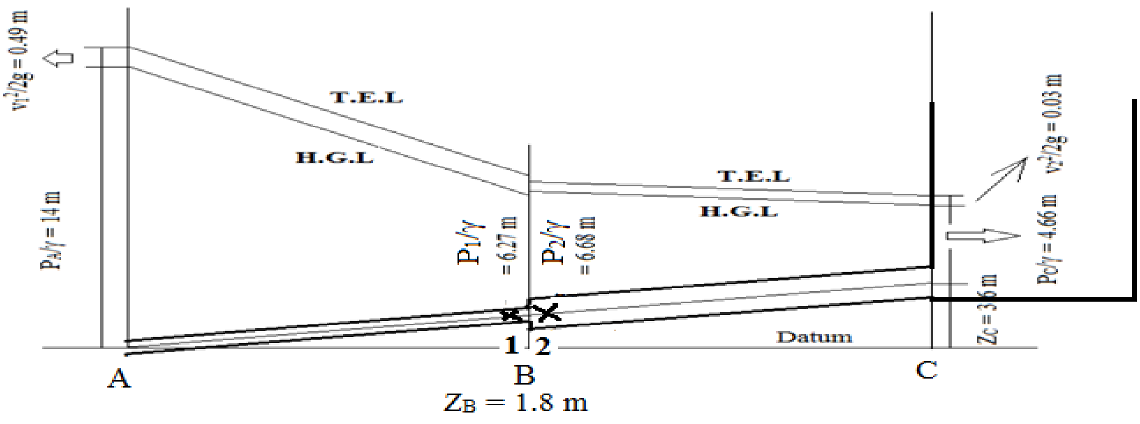
(e) The pressure at E is the highest due to the lowest position energy.

(f) P_B and P_D are the same due to the same position and velocity heads.

7- $d_n = 0.372$ m $= 37.2$ cm

8- (a) $P_C/1 = 4.66$ m $= 4.66 \times (1000/10^4) = 0.47$ kg/cm^2

(b)



9- Q = 0.164 m^3/s

Q = 0.162 m^3/s

10- Lecture Notes, Example 6.

11- Lecture Notes, Example 8.

12- Lecture Notes, Example 10.