UNIVERSITY OF JOHANNESBURG

Program	:	BACHELOR OF ENGINEERING TECHNOLOGY: CIVIL
Subject	:	**SCIENCE (FLUID MECHANICS) 1B**
Code	:	**(FLMCIB1)**
Assessment	:	FINAL EXAMINATION
Date	:	21 November 2017
Duration	:	08:30 - 11:30
Weight	:	40: 60
Total Marks	:	85
Examiner	:	Mr. D.T Chabalala
Moderator	:	Mr. N. L Baloyi
Number of pages	:	Pages: 7 including the cover page and annexures.
Instructions	:	THIS IS A CLOSE BOOK EXAMINATION

1. This paper contains 7 questions
2. PLEASE ANSWER **ALL** QUESTIONS
3. Any additional material is to be placed in the answer book and must indicate clearly the question number, your name, and Student number.

QUESTION 1 **(8)**

If oil having 4.0 KN weight occupies a volume 4.5 m^3 of the container in which it is contained, calculate specific weight, specific gravity, specific volume.

QUESTION 2 **(12)**

A moving plate having area 0.25 m^2 is being pulled with a velocity of 0.3 m/s. And the viscosity of the oil is 9.72 Pa.s. The moving plate is in between two fixed plates which are 12 mm apart. Calculate the drag force

(a) If the moving plate is placed in between the two fixed plates.

(b) If the moving plate is at a distance of 4 mm from the bottom fixed plate.

QUESTION 3 **(15)**

Determine the pressure difference between point A and B, for the set up shown in Figure 3.1.

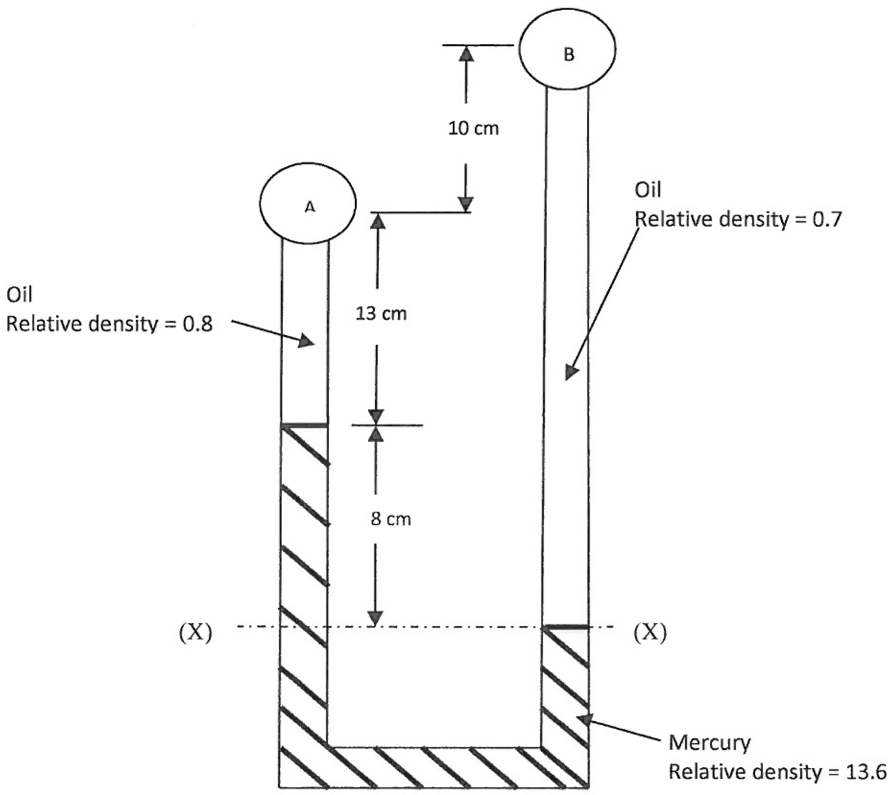

Figure 3.1

QUESTION 4 **(15)**

A plane surface in the shape of a rectangle having a square hole in it is immersed in a liquid having specific gravity of 0.8 such that the one of its longer side is at 2 m below the surface level of the liquid free surface and is of dimensions as shown in the Figure 4.1. Determine the total pressure force acting on the rectangular plane surface with square hole in it and also the center of pressure.

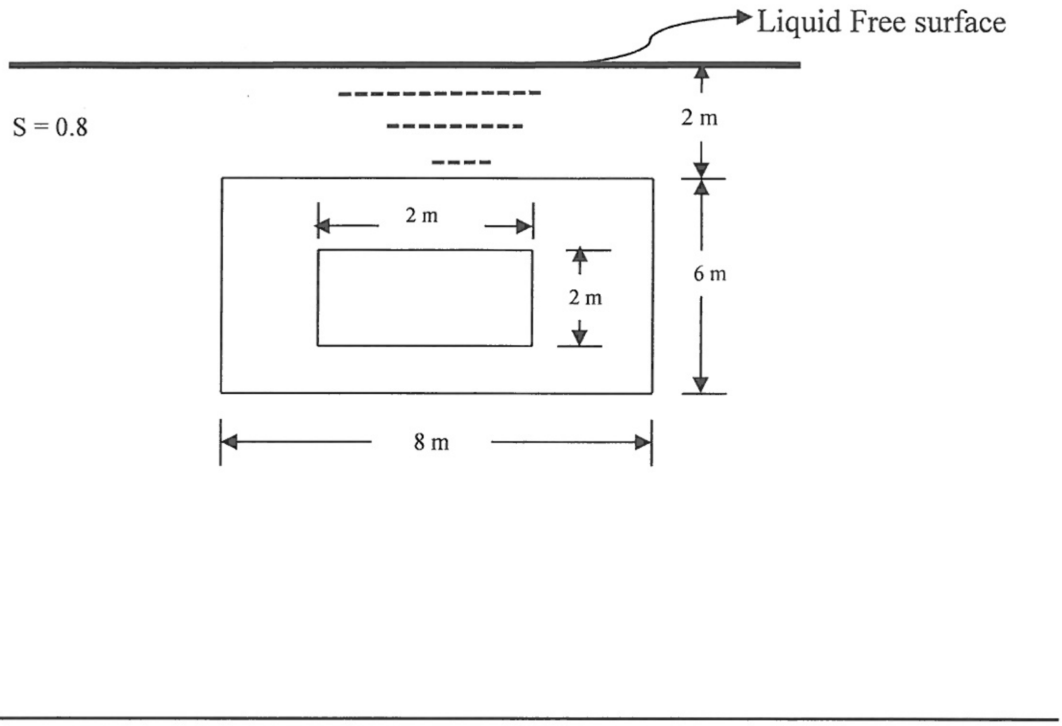

Figure 4.1

QUESTION 5 **(10)**

Is the tank shown in Figure 5.1 filling or emptying? At what rate is the water level rising or falling? Assume that the density is constant. All inflow and outflow velocities are steady and constant over their respective areas.

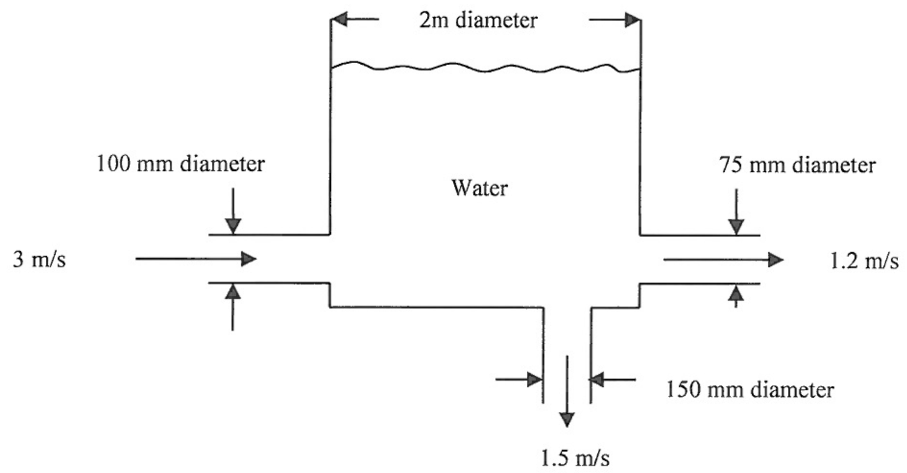

Figure 5.1

QUESTION 6 (10)

For the pipeflow system shown in figure 6.1 the following data are available:

Item	Point 1	Point 2
Diameter	20 cm	30 cm
Elevation (m)	103.00	106.00
Pressure		75 KPa
Velocity	2.5 m/s	

Calculate the pressure at A when the flow is from B to A.

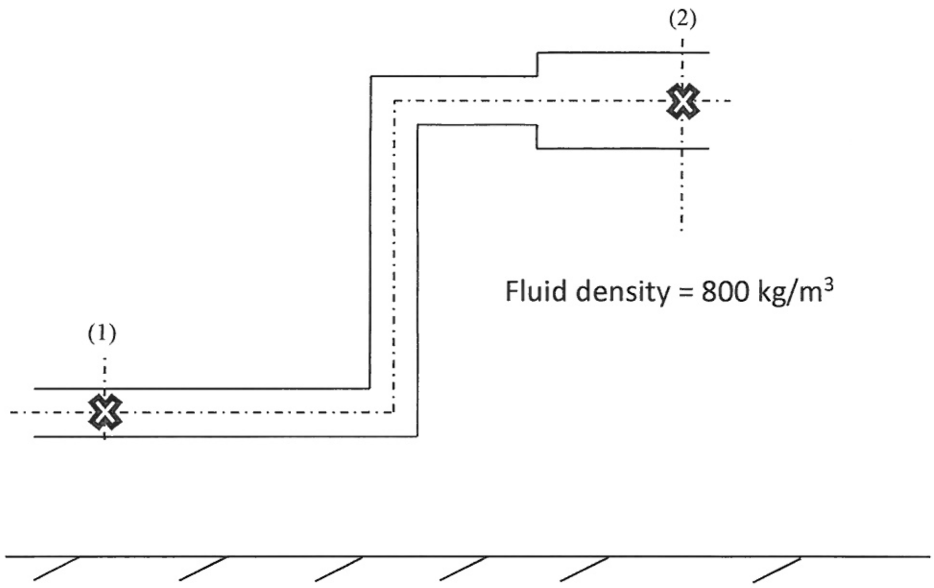

Figure 6.1

QUESTION 7 **(15)**

An open channel of trapezoidal section has a base width of 2.5 m and sides inclined at 60 ° to the horizontal. The bed slope is 1 in 500. It is found that when the discharge of 1.5 m^3/s the normal depth is 0.5 m. Using Manning's formula calculate the discharge when the normal depth in 0.70 m.

GOOD LUCK TO YOU ALL!!!!!!!

Formulae

$$p = \rho g h = \gamma h$$

$$p = \frac{F}{A}$$

$$\gamma = \rho g$$

$$\tau = \frac{F}{A} = \mu \frac{dv}{dy}$$

$$\nu = \frac{\mu}{\rho}$$

$$I_{rect} = \frac{1}{12} b d^3$$

$$I_{circle} = \frac{\pi d^4}{64}$$

$$I_{triangle} = \frac{b h^3}{36}$$

$$F = \gamma A \bar{y}$$

$$\bar{h} = k^2 \frac{\sin^2 \theta}{\bar{y}} + \bar{y}$$

$$F_h = \gamma A_p \bar{y}$$

$$F_v = \rho g V = \gamma V$$

$$R = \sqrt{F_h^{\,2} + F_v^{\,2}}$$

$$\tan^{-1} \Theta = \frac{F_v}{F_h}$$

$$BM = \frac{I}{V}$$

$$I = A k^2$$

$$z_1 + \frac{p_1}{\rho g} + \frac{v_1^2}{2g} + h_p \quad = \quad z_2 + \frac{p_2}{\rho g} + \frac{v_2^2}{2g} + h_l$$

$$v = \frac{1}{n} m^{\frac{2}{3}} i^{\frac{1}{2}}$$

$$F = \rho Q (v_2 - v_1)$$

$$f_1 ; f_2 = \pm \frac{F}{A} \pm \frac{My}{I}$$

$$P = \rho g Q H$$

$$Q = av$$