



UNIVERSITY OF GHANA

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BSc. ENGINEERING SECOND SEMESTER EXAMINATIONS: 2012/2013

FAEN 204: FLUID MECHANICS (3 Credits)

INSTRUCTION: ANSWER ALL QUESTIONS.

TIME ALLOWED: TWO AND HALF (2½) HOURS

1. Provide the appropriate word(s) to complete the following statements
 - (a) Fluids can be either (i)such as (ii).....or (iii)
such as (iv).....
 - (b) The product of the density of a liquid and acceleration due to gravity is the
(i).....of the liquid.
 - (c) (i).....refers to the change in volume of a fluid that is subjected to a
change in pressure on it.
 - (d) The ease with which a fluid flows through a small diameter orifice is an indication of its
(i).....
 - (e) When pressure measurement is made relative to atmospheric pressure the resulting
pressure is called (i).....but when it is made relative to a perfect vacuum, the
resulting pressure is called (ii).....
 - (f)is the tendency of a fluid to exert a supporting force on a body
placed in the fluid.
 - (g) (i).....refers to the ability of a body to return to it's (ii).....
after being tilted about a horizontal axis.
 - (h) A body in a fluid, whether floating or submerged is buoyed up by a force equal to the
..... displaced of fluid
 - (i) If a pipe flow system is arranged so that the fluid flows through a continuous line without
branching it is referred to as (i)..... conversely if the flow braches into
two or more lines, it is referred to as (ii).....

(15 Marks)

2. (a) State mathematically the General Energy Equation for flow of fluids in closed circular
pipes and with devices used to control the flow. Define the terms in the equation.

(8 Marks)

(b) Fig.1 below shows the turbine for a mini-hydro-electric project for a village. Water is flowing at the rate of 115 L/min through the turbine. The pressure at A is 700 kPa and the pressure at B is 125 kPa. It is estimated that due to friction in the piping, there is an energy loss of 4.0 Nm/N of water flowing in the system. Calculate

(i) The power delivered to the turbine by the water (12 Marks)

(ii) The power output if the mechanical efficiency of the turbine is 85 percent.

(5 Marks)

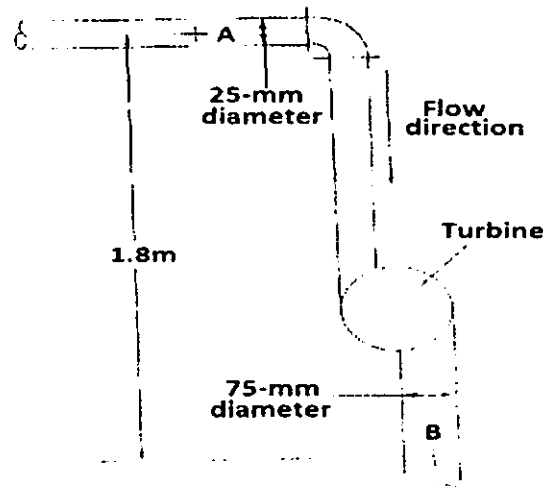


Fig. 1

3. (a) Show that the relationship between a change in elevation in a liquid, h , and a change in pressure Δp , is $\Delta p = \gamma h$, where γ is the specific weight of the liquid

(8 Marks)

(b) Fig. 2 below shows the diagram of the hydraulic system for a vehicle lift. An air compressor maintains pressure above the oil in the reservoir. What must the air pressure be if the pressure at point A should be at least 1,242 kPa (gauge).

(12 Marks)

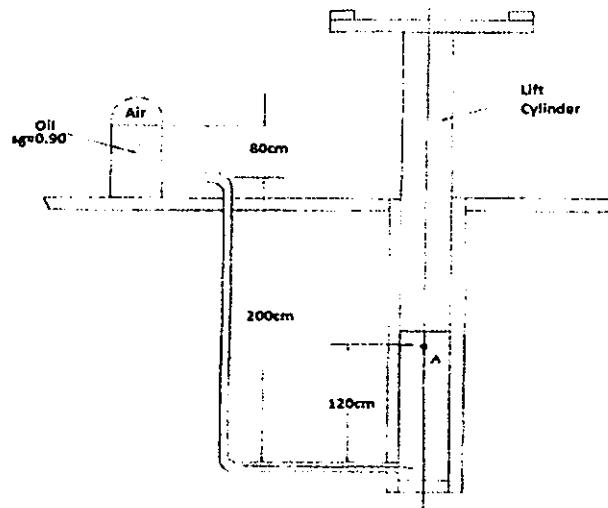


Fig. 2

4. (a) State
- The relationship used to differentiate between Laminar and Turbulent flows. **(4 Marks)**
 - Darcy's equation for friction head loss in a pipe flow system. **(4 Marks)**
- (b) In a chemical processing plant, glycerin must be delivered to point B with a pressure of 550 kPa. A pump is located at point A, 21 m below point B, and the two points are connected by 240 m of plastic pipe having an inside diameter of 150 mm. If the flow is 70 lit/sec, calculate, the required pressure at the outlet of the pump. Given, density of glycerin is 1263 kg/m^3 and kinematic viscosity of glycerin is $9.48 \times 10^{-1} \text{ Pa} \cdot \text{s}$. **(12 Marks)**
5. (a) Define the following terms in open channel flow.
- Hydraulic Radius **(4 Marks)**
 - Hydraulic Depth **(4 Marks)**
- (b) Froude Number, N_F , is defined as $N_F = A/B$. Define A and B **(4 Marks)**
- (c) The trapezoidal channel whose bottom width is 3.0 m and sides slope at 45° , carries water from a water-cooled refrigeration unit to the cooling pond. The available slope is 10 cm over a distance of 100 m. If the maximum depth of flow is 40 cm, calculate the discharge. Assume $n = 0.017$ **(8 Marks)**