هندسة القوى الميكانيكية

Mansoura University Faculty of Engineering Dept. of Power Mech. Eng. Course Title: Fluid Mechanics1 Course Code: MPE4123		1st year Mech. May 2013 Exam Type: Final Time: 3 Hours Full Mark: 100

Answer all the following questions.

Question 1

a) In Fig. 1, if atmospheric pressure = 101.33 kPa and the bottom pressure is 242 kPa absolute, what is the specific gravity of fluid X? [8 Marks]

b) Gate AB in Fig. 2 is a homogeneous mass of 180 kg, 1.2 m wide into the paper, resting on smooth bottom B. For what water depth h will the force at point B be zero? [10 Marks]

Question 2

a) The uniform body A in Fig. 3 has width *b* into the paper and is in static equilibrium when pivoted about hinge O. What is the specific gravity of this body when (a) h = 0; and (b) h = R? [10 Marks]

b) The height of the portion of a cubic ice block that extends above the water surface is 10 cm, Fig. 4. Determine the height of the ice block below the surface if the top surface of the ice block is parallel to the surface of the sea. The specific gravities of ice and seawater are given to be 0.92 and 1.025, respectively. [8 Marks]

Question 3

a) The tank of water in Fig. 5 is 12 cm wide into the paper. If the tank is accelerated to the right in rigid-body motion at 6 m/s^2, compute (a) the water depth at AB, and (b) the water force on panel AB. The tank sides are high enough. [8 Marks]

b) A velocity field is given by:

$u = 0.20+1.3x+0.85y \qquad v = -0.50+0.95x-1.3y$

1- Calculate the acceleration components at point (x,y) = (1,2)
2- Is this flow steady or unsteady?
3- Is this flow rotational or irrotational flow?
4- Is this flow satisfies the continuity equation? [10 Marks]

Question 4

a- It is desired to determine the wave height when wind blows across a lake. The wave height, H, is assumed to be a function of the wind speed, V, the water density ρ_w, the air density ρ_{air}, the water depth, *d*, the distance from the shore ℓ, and the acceleration of gravity, *g*. Use d, V, and ρ_w as repeating variables to determine a suitable set of π terms that could be used to describe this problem. [12 Marks]

b- A nozzle is attached to a vertical pipe and discharges water into the atmosphere as shown in Fig. 6. When the discharge is 0.1 m^3/sec, the gage pressure at the

P.T.O.

flange is 40 kPa. Determine the vertical component of the anchoring force required to hold the nozzle in place. The nozzle has a weight of 200 N, and the volume of water in the nozzle is 0.012 m^3. Is the anchoring force directed upward or downward? [10 Marks]

Question 5

a- Air flows through a pipe that consists of two sections at a specified rate of 200 lit/sec. Determine the differential height h of a water manometer placed between the two pipe sections Fig. (7). The flow through the pipe is steady, incompressible, and with negligible friction. The air column in the manometer can be ignored. [12 Marks]

b) Water is to flow from reservoir A to reservoir B through a cast-iron pipe (f = 0.032) of length 20 m at a rate of 0.0020 m^3/sec as shown in Fig. (8) . The system contains a sharp-edged entrance (k_{ent} = 0.5) and six regular threaded 90° elbows (k_{elb} = 1.5), take (k_{exit} = 1). Determine the pipe diameter needed. [10 Marks]

أطيب التمنيات بالنجاح

Prof. Dr. Hassan Mansour

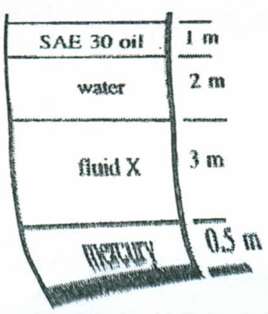


Fig. 1

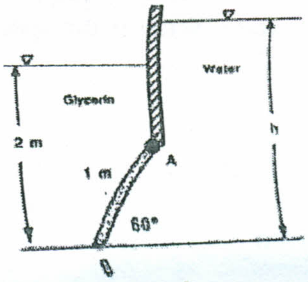


Fig. 2

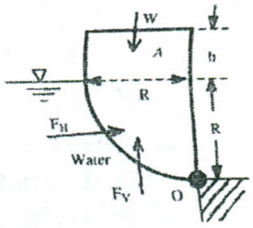


Fig. 3

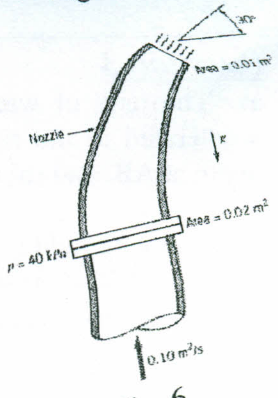


Fig. 6

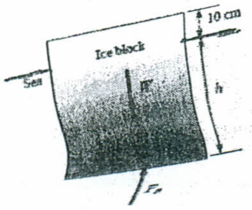


Fig. 4

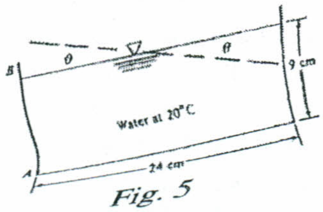
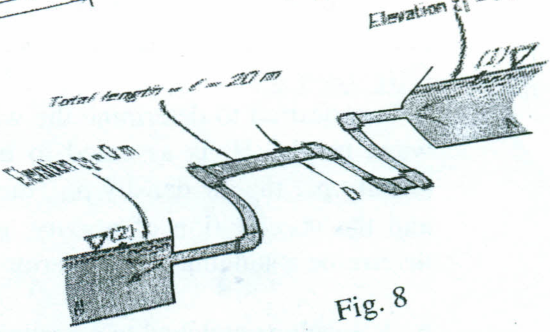


Fig. 5



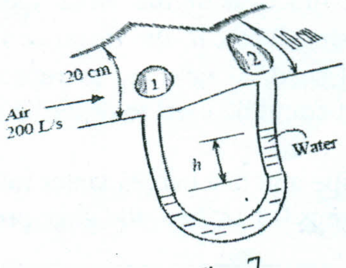


Fig. 7

Fig. 8