Mansoura University	1^{st} year Mech. Power. Eng..
Faculty of Engineering	May 2014
Dept. of Power Mech. Eng.	Exam Type: Final
Course Title: Fluid Mechanics 1	Time: 3 Hours
Course Code: MPE4123	Full Mark: 100

Answer all the following questions.

Question 1

a- A circular disk of diameter (d) is rotated in a liquid of viscosity (μ) at a small distance (h) from a fixed surface. Derive an expression for the torque T, necessary to maintain an angular velocity (ω) [8 Marks]

b- A gasoline line is connected to a pressure gage through a double-U manometer. For a given reading of the pressure gage, determine the gage pressure of the gasoline line. Fig.1. The specific gravities of oil, mercury, and gasoline are given to be 0.79, 13.6, and 0.70, [10 Marks]

Question 2

a- Gate ABC in Fig. 2 has a fixed hinge at B and is 2 m wide into the paper. If the water level is high enough, the gate will open. Compute the depth h for which this happens. [10 Marks]

b- Consider a wooden cylinder (SG = 0.6) 1 m in diameter and 0.8 m long. Would this cylinder be stable if placed to float with its axis vertical in oil (SG = 0.85)? [8 Marks]

Question 3

a- The U-tube of Fig. 3 contains mercury and rotates about the off-center axis *a–a*. At rest, the depth of mercury in each leg is 150 mm as illustrated. Determine the angular velocity for which the difference in heights between the two legs is 75 mm. [8 Marks]

b- A fish tank moves in the cabin of an elevator, Fig. 4. Determine the pressure at the bottom of the tank when the elevator is stationary, moving up with an acceleration of 3 m/sec^2, and moving down with the same acceleration. [10 Marks]

Question 4

a- Determine the flow rate through the pipe in Fig. 5. [8 Marks]

b- For the given flow field,

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

Determine the acceleration. [6 Marks]

c- The velocity components for a certain incompressible, steady flow field are:

$u = x^2 + y^2 + z^2 \quad , \quad v = xy + yz + z \quad \text{and} \quad w = ?$

Determine the form of the z component, w, required to satisfy the continuity equation [6 Marks]

Question 5

a- A Pitot-static probe equipped with a water manometer is held parallel to air flow as shown in Fig. 6., The differential height of the water column is measured. Determine the air velocity. The density of air is given to be 1.25 kg/m^3. [12 Marks] b- The system in Fig. 7 consists of 1200 m of 5 cm cast iron pipe, two 45° and four 90° flanged long-radius elbows, a fully open flanged globe valve, and a sharp exit into a reservoir. If the elevation at point 1 is 400 m, what gage pressure is required at point 1 to deliver 0.005 m^3/s of water into the reservoir?. Take coefficient of friction f = 0.02 . assume any missing data. [14 Marks]

أطيب التمنيات بالنجاح

Prof. Dr. Hassan Mansour

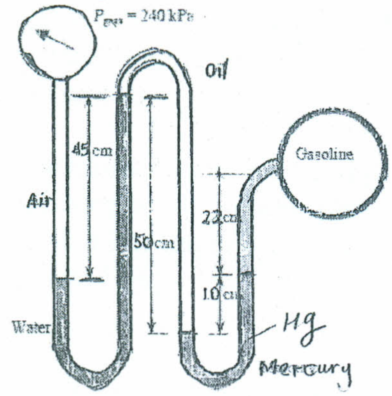

Fig. 1

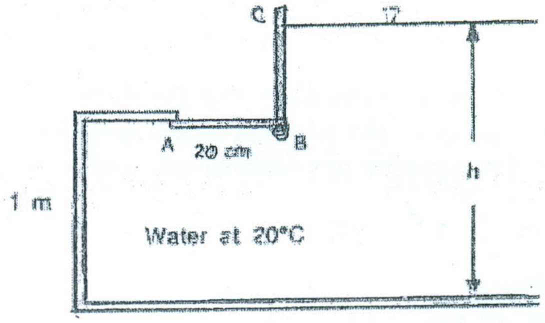

Fig. 2

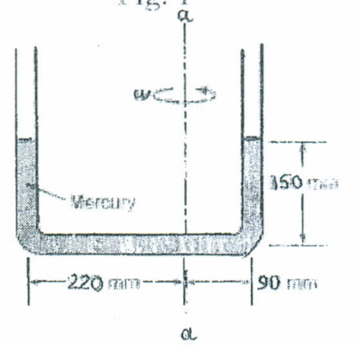

Fig. 3

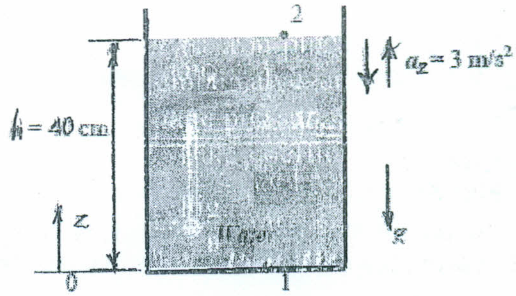

Fig.4

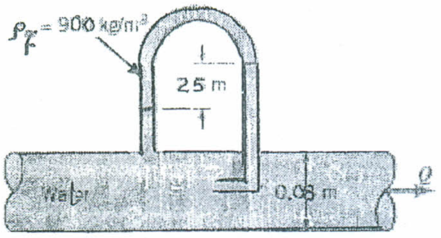

Fig. 5

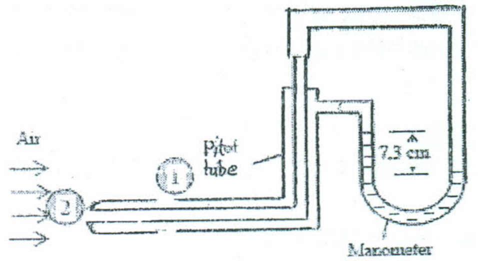

Fig. 6

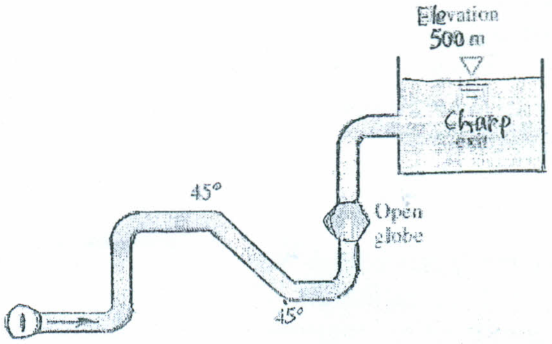

Fig. 7