Mansoura University
Faculty of Engineering
Dept. of Power Mech. Eng.
Course Title: Fluid Mechanics
Course Code: MPE6222

2nd year TEXT
May 2012
Exam Type: Final
Time: 3 Hours
Full Mark: 60

Answer all the following questions.

Question (1)

a- A flat plate is pulled to the right above a 0.1-cm-thick layer of viscous liquid at a speed of 1 m/s. If the force required for pulling the plate is 200 N/1 m^2, calculate the viscosity of the liquid. [6 Marks]

b- A circular container of diameter D = 0.1 m is filled with water. A weightless piston is placed on the liquid surface and the water level stabilizes (also in the small tube) to a level of h. Next, a weight of 10 kg is placed on the piston causing the liquid in the small tube to rise. Calculate how high will the liquid rise in the small tube and how deep the piston will sink,.(Fig. 1) [6 Marks]

Question (2)

a- A 3-m-wide rectangular plate is sealing the bottom of a pool filled with water, as shown in the Fig. 2. If h = 5 m, find the magnitude of the hydrostatic force acting on the plate. Find the location of the center of pressure along the plate (measured from the top). [8 Marks]

b- A cylindrical container is filled with water as shown in Fig. 3.
(a) Calculate the slope of the liquid–air interface if the container is accelerated at 7 m/sec^2 in the x direction,
(b) What is the pressure at the bottom of the container (at point A)?
(c) At what acceleration will the water spill out? [6 Marks]

Question (3)

a- A cylinder with negligible mass is held in a vertical position by a weight W = 200 N. If its dimensions are D = 0.4 m and l = 0.7 m, calculate how deep it will sink in the water. (Fig. 4) [6 Marks]

b- The orifice shown in the Fig. 5 is used to measure the water flow in the pipe. The pressure difference across the orifice registers as a column of 10 cm water. R_{pipe} = 20 cm and $O_{orifice}$ = 10 cm, and the discharge coefficient is C_D = 0.6, calculate the mass flow rate in the pipe. [8 Marks]

Question (4)

A cylindrical tank with a diameter D is filled with water to a level H. At a time t = 0, a small opening with an area A_e is opened at the bottom. Develop a formula for the time required to empty the tank.. If the diameter of the tank D = 20 cm, H = 80 cm, and the opening area A_e is 3 cm^2, calculate how long it will take to empty the container. [10 Marks]

P.T.O

Question (5)

Water is flowing out of the taller container through 0.05-m-diameter pipe with 130 m long., as shown in Fig.6. Assuming a friction factor of f = 0.03 in the pipe system, $K_1 = K_2 = 0.3$, $K_3 = 0.2$, calculate the flow rate in the pipes if $z_1 = 12$ m and $z_2 = 5$ m

[10 Marks]

Dr. Mohamed Mansour

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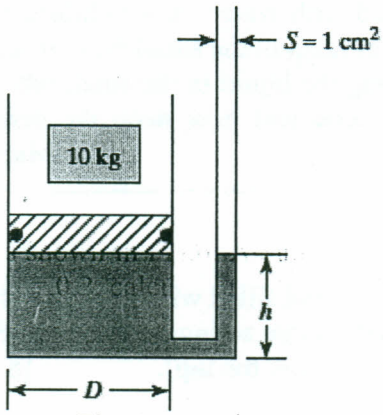

Fig. 1

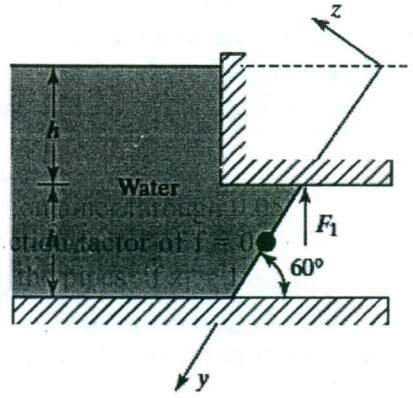

Fig. 2

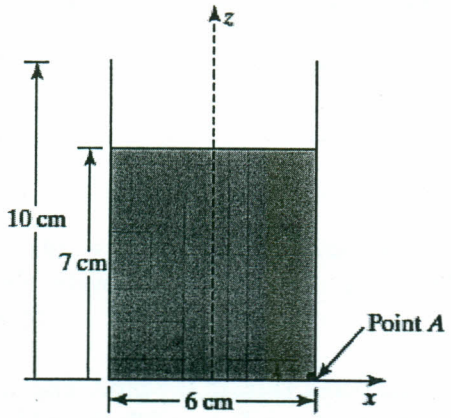

Fig. 3

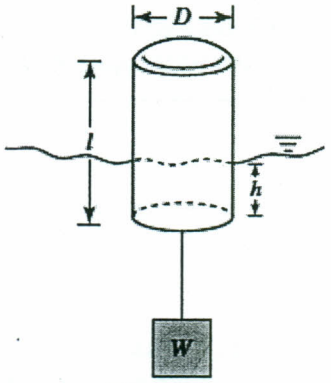

Fig. 4

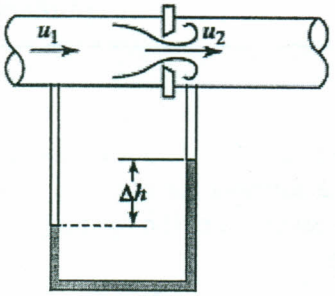

Fig. 5

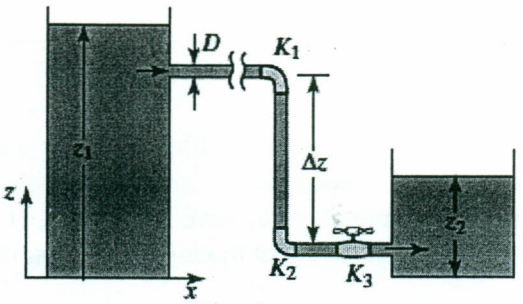

Fig. 6