UNIVERSITY OF SWAZILAND
Faculty of Health Sciences
Department of Environmental Health Sciences

BSc Environmental Health

MAIN EXAMINATION PAPER DECEMBER 2013

TITLE OF PAPER	:	WATER DISTRIBUTION
COURSE CODE	:	EHS:586
DURATION	:	2 HOURS
MARKS	:	100
INSTRUCTIONS	:	THERE ARE FIVE QUESTIONS IN THIS EXAM
	:	ANSWER ANY FOUR OF THE FIVE QUESTIONS
	:	EACH QUESTION CARRIES 25 MARKS
	:	NO PAPER SHOULD BE BROUGHT INTO OR OUT OF THE EXAMINATION ROOM

QUESTION ONE (25 Marks)

1A. The tanks system shown in Figure Q1A below is filled with oil of specific gravity 0.85. The tank on the left side is open to the atmosphere. Calculate the gauge pressures at points A and B.

.....[12 Marks]

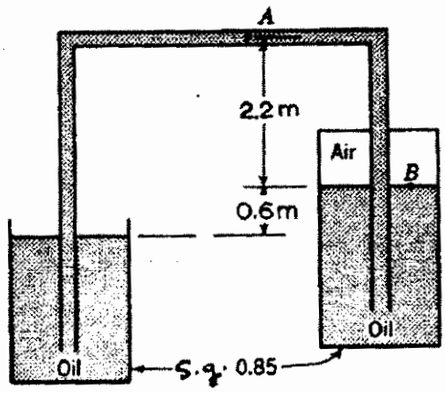


Fig Q1A

1B. A manometer is attached to a tank containing three different fluids as shown in Figure Q1B. What will be the difference in elevation, y, of the mercury column in the manometer? .....[13 Marks]

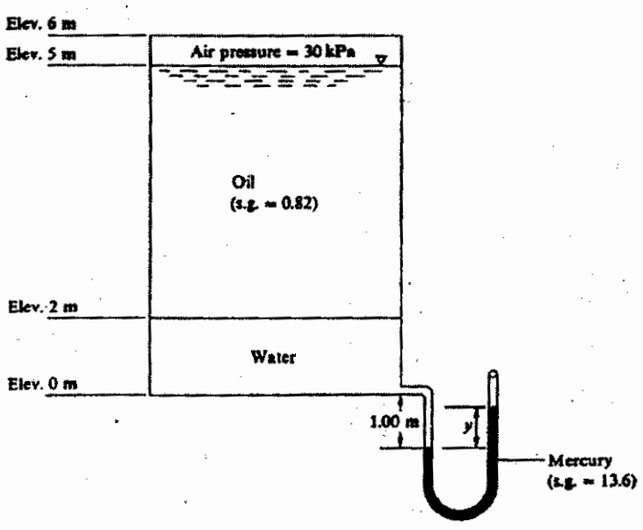


Fig Q1B

QUESTION TWO (25 Marks)

Gate AB is semi-circular and is hinged at B. It is holding the water shown in Figure Q2.

2A. Determine the magnitude and location of the hydrostatic force acting on the gate.

.....[13 Marks]

2B. Calculate the magnitude of the force P applied at A and that is required to close the gate.

.....[12 Marks]

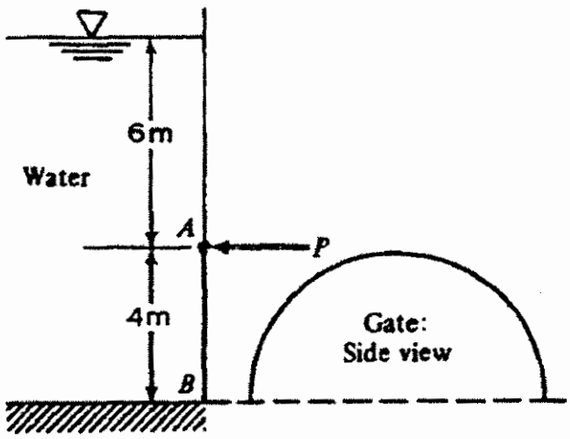
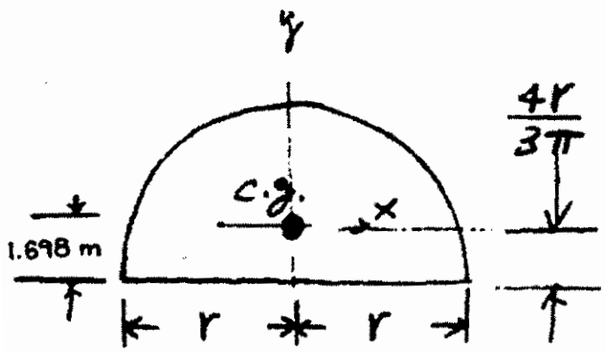


Fig. Q2



$$I_{xx} = 0.10976r^4$$

$$I_{xy} = 0$$

QUESTION THREE (25 Marks)

Water is to be delivered from a reservoir through a pipe to a lower level and discharged into the air, as shown in Figure Q3 below. If the head loss in the entire system is 11.58m, determine the vertical distance Z between the point of water discharge and the water surface in the reservoir.

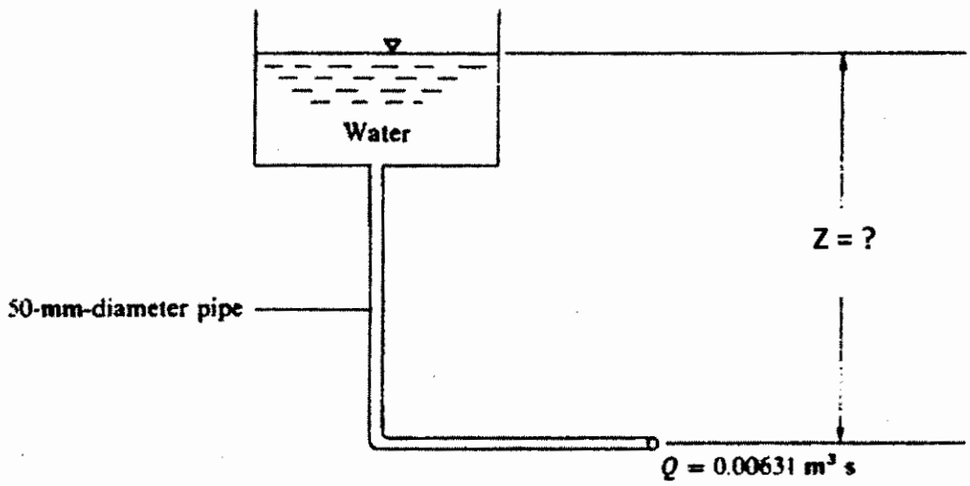


Fig. Q3

QUESTION FOUR (25 Marks)

Three pipes designated 1, 2 and 3 connect the three reservoirs as shown in Figure Q4 below. The elevations for the three reservoirs are given as Z_1 = 20m , Z_2 = 100 m and Z_3 = 40m. Using the pipe data shown in the figure, calculate the discharge for each of the pipes 1, 2 and 3 in units of m^3/sec. Also indicate the direction of flow in each of the pipes. Use the Darcy-Weisbach formula for the calculation of head loss in the pipes and assume that the flow is fully turbulent.

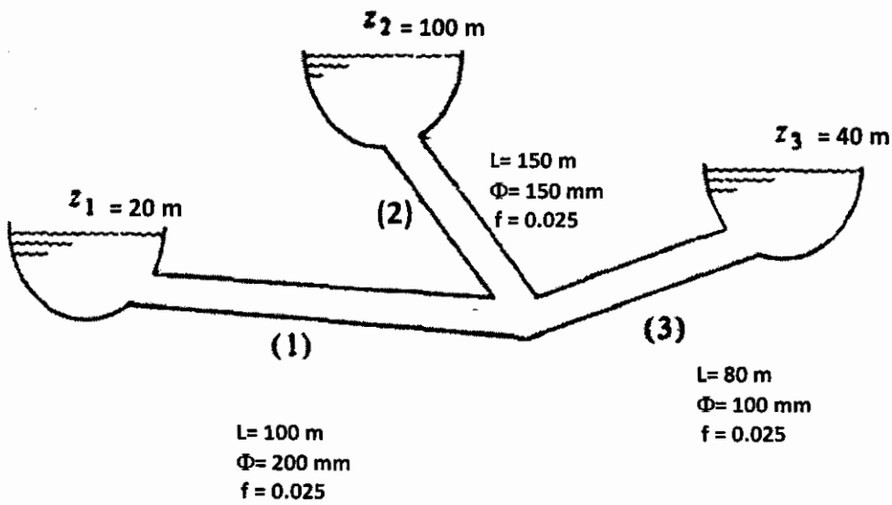


Fig. Q4

Darcy-Weisbach Head loss formula

$$H_L = \frac{8fLQ^2}{\pi^2 g D^5}$$

QUESTION FIVE (25 Marks)

The rectangular channel shown in Figure Q5 below is to carry 15 m^3/sec of water. The maximum allowable velocity of flow is 1.0 m/sec to avoid scouring. The channel slope is 0.03%. Determine the depth and width of the channel. Assume that Manning's n = 0.013

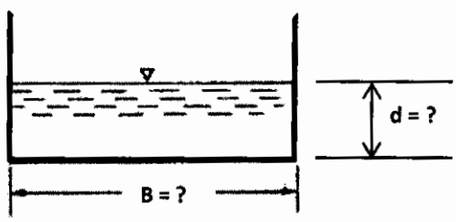


Fig. Q5