



Answer all the following five questions.

Any other required data may be reasonably assumed.

الامتحان مكون من صفحتين

Question No. (1) [14 marks] (A5, A13, B2, B7, C1)

The quarter cylinder AB of radius 5m, Fig. (1), is 10 m long and hinged at point (A). Calculate the value and location of the horizontal and vertical components of the hydrostatic force. Also, calculate the value of the horizontal force F acting at point (B) to keep the gate closed.

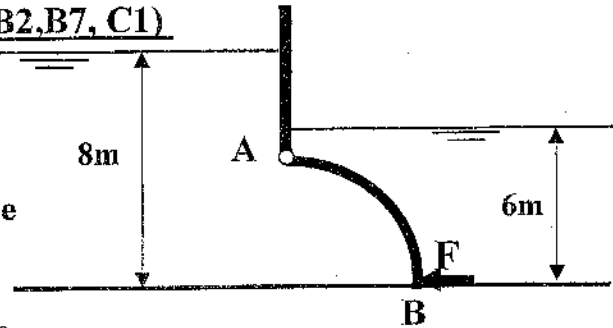


Fig. (1)

Question No. (2) [13 marks] (A5, A13, B2, C1)

A vertical cylindrical tank of 4m diameter and 6m height deep is filled with water to a depth of 5m, is rotated about its vertical axis with angular velocity (ω) = 4 rad/sec., calculate the volume of spilled out water and the exposed area at the bottom. Also, draw the hydrostatic pressure diagram at the bottom.

Question No. (3) [14 marks] (A5, A13, B2, B7, C1)

a) A square orifice of side 2m is discharging water between two tanks where the water level of the higher tank is located at 5m above the higher edge of the orifice. While, the water level of the lower tank is located at 1m above the higher edge of the orifice, calculate the discharge passing through the orifice, $C_d = 0.62$

a) calculate the discharge passing over the rectangular submerged weir shown in Fig. (2), where crest length = 8m, $C_d = 0.60$. [7 marks]

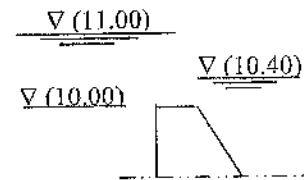


Fig. (2)

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Question No. (4) [17 marks] (A5, A13, B2, C1)

A vertical tank consists of upper cylindrical part and lower conical part as shown in Fig.(3). The tank has two identical orifices and is connected with a pipe at the bottom, where pipe diameter = 30cm, pipe length =400m, $\lambda =0.02$. It is required to calculate the time required to empty the tank, orifice diameter = 8cm, $c_d = 0.61$

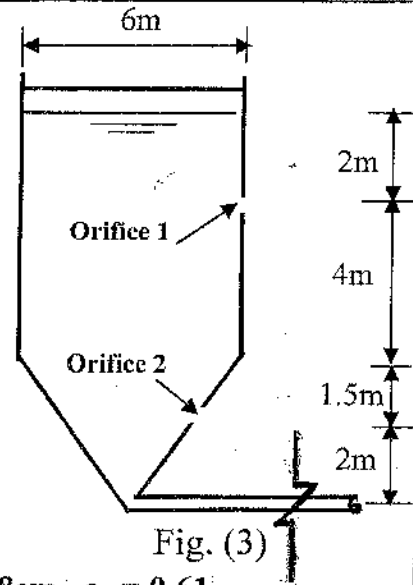


Fig. (3)

Question No. (5) [17 marks] (A13, B2,B14, C1,C7)

Four pipes connect four tanks where the pipes meet at point J as shown in Fig. (4). It is required to calculate the discharge passing in the four pipes (a, b, c and d) where the pipes have the following data:

$L_a = 4000 \text{ m}, D_a = 0.5 \text{ m}, \lambda_a = 0.02$, $L_b = 5000 \text{ m}, D_b = 0.4 \text{ m}, \lambda_b = 0.016$

$L_c = 7000 \text{ m}, D_c = 0.35 \text{ m}, \lambda_c = 0.025$, $L_d = 3000 \text{ m}, D_d = 0.3 \text{ m}, \lambda_d = 0.022$

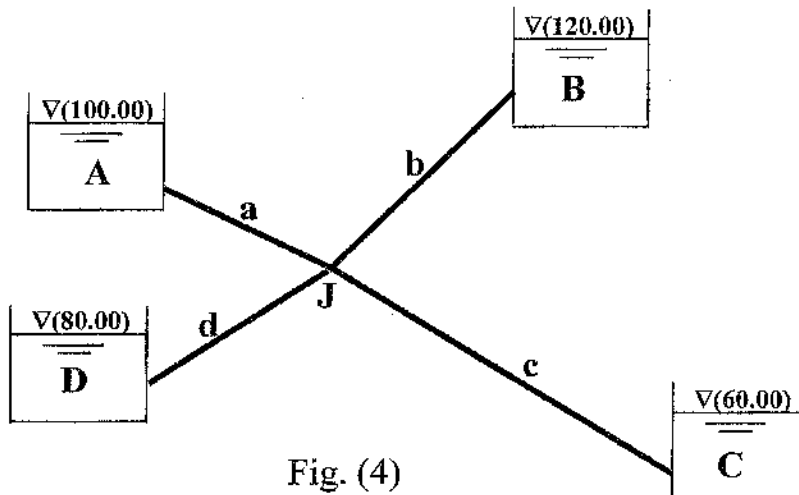


Fig. (4)

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