

## Solution

Q.P. Code : 76819

[Time: Three Hours]

[Marks:80]

- N.B:
1. Question.No.1 is compulsory.
  2. Attempt any three questions from remaining five questions.
  3. Assume suitable data wherever necessary.

2 a

10

b

10

Dia of orifice  $\rightarrow d_0 = 15 \text{ cm}$   $\therefore$  Area  $a_0 = \frac{\pi}{4} (15)^2 = 176.7 \text{ cm}^2$   
Dia of pipe  $\rightarrow d_1 = 30 \text{ cm}$   $\therefore$  Area  $a_1 = \frac{\pi}{4} (30)^2 = 706.85 \text{ cm}^2$   
Spgr of oil,  $S_o = 0.9$ .  
Reading of diff manometer,  $x = 50 \text{ cm}$  of mercury

2. Differential Head,  $h = x \left[ \frac{S_g}{S_o} - 1 \right] = 50 \left[ \frac{13.6}{0.9} - 1 \right] \text{ cm of oil}$   
 $= 50 \times 14.11 = 705.5 \text{ cm of oil}$

The rate of flow,  $Q$  is given by,

$$Q = C_d \frac{a_0 a_1}{\sqrt{a_1^2 - a_0^2}} \times \sqrt{2gh}$$
$$= 0.64 \times \frac{176.7 \times 706.85}{\sqrt{(706.85)^2 - (176.7)^2}} \times \sqrt{2 \times 9.81 \times 705.5}$$
$$= \frac{9404631.78}{684.4} = 137414.25 \text{ cm}^3/\text{s} = 137.414 \text{ liter}/\text{sec}$$

Ans.

3 a

10

b

10

Q.P. Code :

4

a

(a) Sp. gr. of liquid,  $S_1 = 0.8$

Sp. gr. of mercury,  $S_2 = 13.6$

Density of liquid,  $\rho_1 = 800$

Density of mercury,  $\rho_2 = 13.6 \times 1000$

Difference of mercury level  $h_2 = 40 \text{ cm} = 0.4 \text{ m}$

Height of liquid in left limb  $h_1 = 15 \text{ cm} = 0.15 \text{ m}$

Let the pressure in pipe =  $p$

Equating pressure above datum line A-A we get-

$$\rho_2 g h_2 + \rho_1 g h_1 + p = 0$$

$$\therefore p = - [\rho_2 g h_2 + \rho_1 g h_1]$$

$$= - [(13.6 \times 1000 \times 9.81 \times 0.4) + (800 \times 9.81 \times 0.15)]$$

$$= - [53366.4 + 1177.2] = - 54543.6 \text{ N/m}^2$$

$$= - 5.454 \text{ N/cm}^2 \text{ Ans.}$$

10

b

10