M R

Ahmed Mahdy

فيزياء	استاتيكا
دوائر كهربية	الكـــترونيات
ميكانيكا الانشائات	هيدروليكا

مدرس خصوصي

اونلاين حضوري

يحصل الطالب علي

- مقاطع فيديوهات لشرح المقرر بشكل وافي
- ملخص للمادة Pdf للمذكرة والمراجعة
- محاضرات مباشرة علي برنامج زووم لمناقشة الأجزاء الغير مفهومة
- تواصل مستمر مع معلم المادة

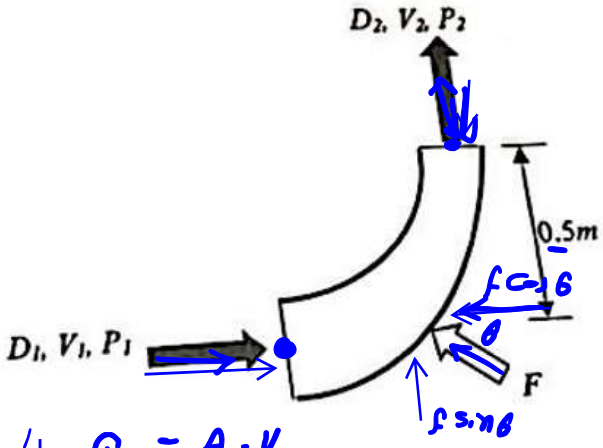
للتواصل

0567630097

0565657741

Question 1 (5 marks)

Water flows horizontally along a 220 mm pipeline fitted with a 90° bend that moves the water vertically upwards. The diameter at the outlet of the bend is 150 mm and it is 0.5m above the centerline of the inlet. If the flow through the bend is 150 litres/s. Assuming *no losses due to friction and ignore the weight of bend and water inside it*, calculate the magnitude and direction of the resultant force, *F*, the bend support must withstand if the pressure at the inlet is 100 kN/m²?



$Q = \frac{150}{1000} = 0.15\ m^3/s$

$\Sigma f = f_T = \rho Q (v_2 - v_1)$

$f_{Tx} = 1000 \times 0.15 \times (v_{2x} - v_{1x})$ (0, 3.941)

$f_{Tx} = -591.9\ N$

$f_{Ty} = 1000 \times 0.15 (8.488 - 0)$

$f_{Ty} = 1273.2\ N$

$f_{1P} = P_1 A_1 = 100 \times 10^3 \times \pi \times \frac{0.22^2}{4} = 3801\ N$ (P, S)

$f_{2P} = P_2 A_2$

$f_{2P} = 66857 \times \pi \left(\frac{0.15^2}{4}\right) = 1181\ N$

$Q = A \cdot V$

$v_1 = \frac{Q}{A_1} = \frac{0.15}{\pi (220 \times 10^{-3})^2 / 4}$

$v_1 = 3.946\ m/s$

$v_2 = \frac{0.15}{\pi \frac{0.15^2}{4}} = 8.488\ m/s$

$\frac{P_1}{\rho g} + \frac{v_1^2}{2g} + z_1 = \frac{P_2}{\rho g} + \frac{v_2^2}{2g} + z_2$ (0.5)

$\frac{100 \times 10^3}{1000 \times 9.81} + \frac{3.946^2}{2 \times 9.81} = \frac{P_2}{1000 \times 9.81} + \frac{8.488^2}{2 \times 9.81} + 0.5$

$P_2 = 66857\ N/m^2$

$$\Sigma f_x = f_{r_x} = -591.9 = -f\cos\theta + 3801$$

$$+f\cos\theta = +4392.9 \rightarrow (1)$$

$$\Sigma f_y = f_{r_y} = 1275.2 = f\sin\theta - 1181\ N$$

$$f\sin\theta = 2456.2 \rightarrow (2)$$

$(2)\ /\ (1)$

$$\tan\theta = \frac{2456.2}{4392.9} \Rightarrow \theta = 29$$

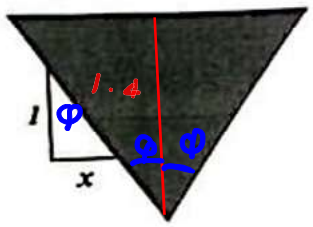
$$\frac{f\cos 29}{\cos 29} = \frac{4392.9}{\cos 29} = 5022.64\ N$$

Question 2 (5 marks)

A channel is required to carry a discharge of 15.0 m³/sec as a critical flow at a depth of 1.40 m, if the channel cross-section is,

a) Rectangular, calculate the required bottom width

b) Triangle, determine the value of x if the side slopes are (x : 1) on each side as shown in the figure below.



$$y_c = \sqrt[3]{\frac{q^2}{g}} = \sqrt[3]{\left(\frac{Q}{b}\right)^2 \frac{1}{g}}$$

$$1.4 = \left(\frac{15^2}{b^2 \cdot 9.81}\right)^{1/3}$$

$$b = 2.89 \text{ m}$$

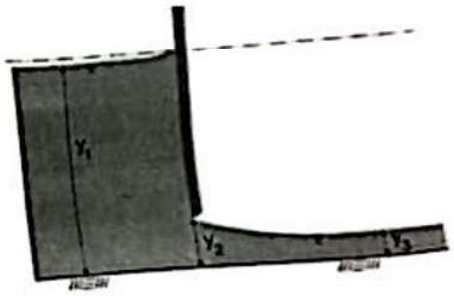
$$\frac{Q^2 T_c}{g A_c^3} = 1 \Rightarrow \frac{15^2 \times 2.8 \tan\phi}{9.81 \times (1.4^2 \tan\phi)^3} = 1$$

$$x = \tan\phi = 2.92$$

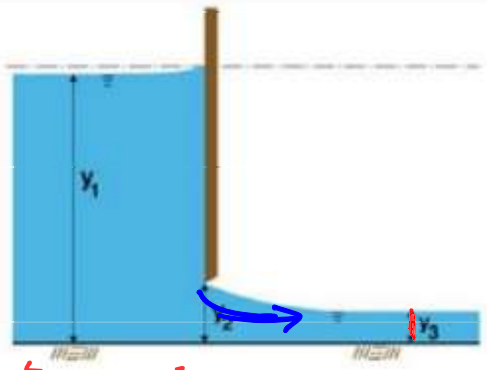
$$\tan\phi = \frac{x}{1} = 2.92$$

Question 3 (5 marks)

A partially open sluice gate in a 5-m-wide rectangular channel carries water at 10 m^3/s. The upstream depth y_1 is 2.5 m. Find the downstream depth, y_3 and Froude number. Assume the velocity upstream the gate is negligible.



1. A partially open sluice gate in a 5-m-wide rectangular channel carries water at 10 m^3/s. The upstream depth y_1 is 2.5 m. Find the downstream depth, y_3 and Froude number.



$q = \frac{Q}{b} = \frac{10}{5} = 2 m^2/s$

$V_1 = \frac{q}{y_1} = \frac{2}{2.5} = 0.8 m/s$

$V_2 = \frac{q}{y_2}$, $V_3 = \frac{q}{y_3}$

the energy equation

$E_1 = E_3$

$y_1 + \frac{V_1^2}{2g} = y_3 + \frac{V_3^2}{2g}$

$2.5 + \frac{0.8^2}{2*9.81} = y_3 + \frac{(\frac{2}{y_3})^2}{2*9.81}$ $\Rightarrow$ $y_3 = 0.302 m$

$2.533 = y_3^2 + \frac{2^2}{2*9.81 y_3^2}$

$0 = y_3^3 - 2.533 y_3^2 + \frac{2^2}{2*9.81}$

Froud number

$Fr = \frac{V_3}{\sqrt{g y_3}} = \frac{\frac{2}{0.302}}{\sqrt{9.81 * 0.302}} = 3.85$

Question 4 (5 marks)

A Hydraulic jump occurs in a 5 m wide rectangular channel carrying 7.5 m^3/s on a horizontal bed. The depth before the jump is 0.30 m find:

a). the depth after the jump

b) the losses of energy in the jump

c) the power lost in the jump

4. A Hydraulic jump occurs in a 5 m wide rectangular channel carrying 8 m^3/s on a horizontal bed. The depth after the jump is 1.5 m. find:
   a) the depth before the jump
   b) the losses of energy in the jump
   c) the power lost in the jump