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i. a. Pressure gradient is constant
b. The flow is uniform
c. The flow is steady

ii. a. diameter of the pipe (m)
b. The density of the fluid passing through the pipe (kg/m³)
c. The viscosity of the fluid (Ns/m²)
d. The velocity of the flow (m/s)

ii.

Aerofoil	Hydrofoil
a. Its a lifting device mainly used in gaseous fluid	Its a lifting device mainly used in liquid fluid
b. Its mainly used for lifting airplanes and jet	Its mainly used to overcome drag and make machines move with a high or velocity in water

1b. Given $\mu = 0.7\,c = 0.7 \times 10^{-2}$ poise $= 0.7 \times 10^{-3}\,Ns/m^2$

$U = 1m/s$

$b = 10mm = 0.01m$

$dp = 60kN/m^2$

$dx = 60m$

Therefore the pressure difference gradient is

$$dp/dx = \frac{-60000}{60} = -1 \times 10^3 N/m^3$$

i. Velocity distribution $= v = Uy/b - \frac{1}{2\mu}\left(dp/dx\right)(by - y^2)$

$$v = 100y + 55555.6y - 555555.6y^2$$

$u = (5.67356\times10^{3})y - (5.7356\times10^{5})y^{2}$

ii. Discharge per unit width $q = \frac{V}{2}b - \frac{b^{3}}{12\mu}\left(\frac{dp}{dx}\right)$

$T = 0.005 + 0.07257$

$= 0.07757\ m^{3}/s/m$

iii. Shear stress at upper plate = @y = b

$\tau = \frac{\mu V}{b} - \frac{1}{2}\left(\frac{dp}{dx}\right)(b - 2y)$

$= \left[\frac{\mu V}{b} - \frac{1}{2}\left(\frac{dp}{dx}\right)(-b)\right]$

$\tau = 0.07 \cdot 5 = -4.71\ N/m^{2}$

(2) Given = H - 0.9 hm

$\rho = 1260\ kg/m^{3}$

$v = u = 1.5\ m/s$

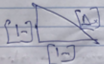
$\frac{dp}{dx} = \frac{(p.1 - p.2)}{\Delta x}$

~~and p.m~~

And $p.1 = p_1 + \rho g z$ (piezometric)

$= 262.36\ kN/m^{2}$

And $p.2 = p_2 + \rho g z$ (piezometric)



$\Delta x = \sqrt{1^{2} + 1^{2}} = \sqrt{2}\ m$

Therefore

$\frac{dp}{dx} = \frac{(-p.1 - p.2)}{\Delta x} = \frac{-(262.36 - 80)}{\sqrt{2}} = -128.948\ kN/m$

i) Velocity distribution $v = V y/b + \frac{1}{2\mu}\left(\frac{dp}{dx}\right)(by - y^2)$

$v = 750y + 11638y - 71637.8y^2$

$v = (7.16378 \times 10^4)y^2 + 565.62y$

ii) Shear distribution $\tau = \frac{\mu V}{b} - \frac{1}{2}\left(\frac{dp}{dx}\right)(b - 2y)$

$\tau = 135 + 644.74 - 128748y$

$\tau = 507.74 - (1.287 \times 10^5)y$

b Maximum flow velocity

At maximum flow velocity $dv/dy = 0$

$0 = (1.4328 \times 10^5)y + 565.62$

$y = 3.7476 \times 10^{-3}$ m

$V_{max} = (7.16378 \times 10^4)(3.7476 \times 10^{-3})^2 + 565.62$

(3.7476×10^{-3})

$V_{max} = 1.12$ m/s

(c) Shear stress upper plate is

(c) $y = b$

Therefore $\tau = 507.74 - (1.287 \times 10^5)y$

$\tau = 777.26$ N/m^2