General

$$p = \rho RT$$

1 bar =100,000 Pa = 100,000 N/m^2

Statics

$$\frac{\partial p}{\partial z} = -\rho g$$

$$p + \rho g h = \text{constant}$$

$$F_H = \iint_A p\,dA = \rho g h_{C.G} A$$

$$h_{C.P} - h_{C.G} = \frac{I_{xx}}{h_{C.G} A}$$

Fluid Behaviour & Flow Similarity

$$Re = \frac{\rho V L}{\mu} = \frac{VL}{\nu}$$

$$M = \frac{V}{a}$$

1-D Flow

$$p + \tfrac{1}{2}\rho V^2 + \rho g z = \text{constant}$$

Control Volume Analysis

$$f_{\text{tot}_x} = \dot{M}_x = \dot{m}\left(V_{ex} - V_{ix}\right)$$
$$f_{\text{tot}_y} = \dot{M}_y = \dot{m}\left(V_{ey} - V_{iy}\right)$$
$$f_{\text{tot}_z} = \dot{M}_z = \dot{m}\left(V_{ez} - V_{iz}\right)$$

$$p_i + \tfrac{1}{2}\rho V_i^2 + \rho g z_i = p_e + \tfrac{1}{2}\rho V_e^2 + \rho g z_e + \rho w_s$$

Potential Flow

$$\frac{\partial^2 \phi}{\partial x^2} + \frac{\partial^2 \phi}{\partial y^2} + \frac{\partial^2 \phi}{\partial z^2} = 0$$

$$C_p = \frac{p - p_\infty}{\tfrac{1}{2}\rho U_\infty^2} = \left(1 - \frac{V^2}{U_\infty^2}\right)$$