All the Textbook You'll Ever Need (Exam 1)

Properties

$\rho_{air} = 1.204\ kg/m^3$ @ 20°C, 1atm
$\mu_{air} = 1.825 \times 10^{-5}\ kg/m\cdot s$

$\rho_w = 998\ kg/m^3$ 20°, 1 atm
$\mu_w = 1.002 \times 10^{-3}\ kg/m\cdot s$
$\gamma_w = 62.3\ lbm/ft^3$

$g = 9.81\ m/s^2 = 32.2\ ft/s^2$
$1\ atm = 14.7\ psi = 101325\ Pa$

Units

Force (=) N (=) $kg\,m/s^2$
Energy (=) J (=) $kg\,m^2/s^2$
Power (=) W (=) $kg\,m^2/s^3$
Pressure (=) Pa (=) $kg/m\,s^2$

μ (=) $\frac{kg}{m\cdot s}$
ν (=) $\frac{m^2}{s}$

* $F = m\cdot a \rightarrow$ (1 lbm) $\times 32.2\ ft/s^2 = 32.2\ lbm\,ft/s^2 \cdot \frac{lbf}{32.2\ lbm\,ft/s^2} =$ (1 lbf)

Defs

$SG = \frac{\rho}{\rho_{H_2O}}$ S.W. $\gamma = \rho g$ $\rho = \frac{MP}{RT}$; $M_{air} = 29$; $M_{H_2O} = 18$

$A = \frac{\pi}{4}D^2$; $V = \frac{\pi}{6}D^3$

$\tau = F/A$; $P = F/A$; $\tau = \mu \frac{du}{dy}$

$P_g = P_{abs} - P_{atm}$,

$\Delta P = \rho g h$; $\frac{dP}{dz} = -\rho g$; $\nabla P = \rho \vec{a}$

$F = PA \rightarrow dF = P\,dA \rightarrow F = \int P\,dA = \int \rho g h\,dA$

- Centroid: $y_c = \frac{1}{A}\int y\,dA$. pressure center
- Buoyancy: F_b = Displaced Fluid weight : F_b = weight object, F_b From P→ ...

$\frac{D}{Dt} = \frac{\partial}{\partial t} + \vec{V}\cdot\nabla$ $\frac{dB_{sys}}{dt} = \frac{d}{dt}\int_{C.V.} \rho b\,d\forall + \int_{C.S.} \rho b\,\vec{V}\cdot\vec{n}\,dA$ → S.S. Const ρ Unif Fixed C.V.

M.B. $\frac{d}{dt}\int_{C.V.} \rho\,d\forall + \int_{C.S.} \rho\,\vec{V}\cdot\vec{n}\,dA = 0 \rightarrow \frac{dm}{dt}_{C.V.} = \dot{m}_{in} - \dot{m}_{out}$

E.B $\frac{dQ}{dt} + \frac{dW_s}{dt} = \frac{d}{dt}\int_{C.V.} \rho\left(u + \frac{v^2}{2} + gz\right)d\forall + \int_{C.S.} \rho\left(u + \frac{P}{\rho} + \frac{V^2}{2} + gz\right)\vec{V}\cdot\vec{n}\,dA$

B.E. $\frac{\Delta P}{\rho} + \frac{\Delta V^2}{2} + g\Delta z = 0$

- Energy, pressure, head forms.