Equation Sheet
Test 1

Fluids

$$\Delta p = -\rho g \,\Delta y$$

$$F = \rho V g$$

$$Av = \text{const}$$

$$p + \tfrac{1}{2}\rho v^2 + \rho g y = \text{const}$$

Circuits

$$E = \frac{q}{\varepsilon_0 A} \qquad E = \frac{V}{d}$$

$$C = \frac{\varepsilon_0 A}{d}$$

$$i = \frac{dq}{dt}$$

Electromagnetism

$$\vec{F} = q\vec{E} + q\vec{v}\times\vec{B} \qquad \vec{F} = i\,\vec{L}\times\vec{B}$$

$$\Delta V = -\int_i^f \vec{E}\cdot d\vec{s} \qquad \vec{E} = \left(\frac{\partial V}{\partial x}, \frac{\partial V}{\partial y}, \frac{\partial V}{\partial z}\right) \equiv \vec{\nabla} V$$

$$d\vec{E} = \frac{1}{4\pi\varepsilon_0}\frac{dq}{r^3}\vec{r} \qquad d\vec{B} = \frac{\mu_0}{4\pi} i \frac{d\vec{s}\times\vec{r}}{r^3}$$

$$\oint \vec{E}\cdot d\vec{A} = \frac{q_{\text{enc}}}{\varepsilon_0} \qquad \oint \vec{B}\cdot d\vec{A} = 0$$

$$\oint \vec{E}\cdot d\vec{s} = -\frac{d\Phi_B}{dt} \qquad \oint \vec{B}\cdot d\vec{s} = \mu_0\varepsilon_0 \frac{d\Phi_E}{dt} + \mu_0 i_{\text{enc}}$$

$$u_E = \tfrac{1}{2}\varepsilon_0 E^2 \qquad u_B = \tfrac{1}{2}\frac{1}{\mu_0}B^2$$

Electromagnetic Waves

$$c = \frac{1}{\sqrt{\mu_0 \varepsilon_0}} \qquad \vec{S} = \frac{1}{\mu_0}\vec{E}\times\vec{B}$$

$$I = \frac{P}{4\pi r^2}$$

$$\Delta p = (1 \text{ or } 2)\frac{\Delta U}{c} \qquad p_r = (1 \text{ to } 2)\frac{I}{c}$$

$$I = I_0 \cos^2\theta$$

$$n_1 \sin\theta_1 = n_2 \sin\theta_2$$

Interference and Diffraction

$$d\sin\theta = n\lambda \qquad d\sin\theta = \left(n - \tfrac{1}{2}\right)\lambda$$

$$I = 4I_0\cos^2\left(\tfrac{1}{2}\Delta\phi\right) \qquad \Delta\phi = \frac{2\pi}{\lambda} d\sin\theta$$

$$a\sin\theta = m\lambda$$

$$a\sin\theta = 1.430297\lambda \;\text{ or }\; 2.459024\lambda$$

$$I_0 = I_m\left(\frac{\sin\alpha}{\alpha}\right)^2 \qquad \alpha = \tfrac{1}{2}\phi = \frac{\pi}{\lambda}a\sin\theta$$

Constants

$$\varepsilon_0 = 8.85\times10^{-12}\ \text{C}^2/\text{N}\cdot\text{m}^2$$

$$\mu_0 = 4\pi\times10^{-7}\ \text{T}\cdot\text{m/A}$$

$$\rho_{\text{air}} \approx 1.21\,\text{kg/m}^3$$

NOT on the Equation Sheet
(Expected to be memorized)
Test 1

Waves

$$v = \lambda f$$

$$k = \frac{2\pi}{\lambda} \qquad f = \frac{\omega}{2\pi}$$

(Think of 2π as having units rad/cycle.)

Electromagnetism

$$\Phi_E = \int \vec{E} \bullet d\vec{A} \qquad \Phi_B = \int \vec{B} \bullet d\vec{A}$$

Electromagnetic Waves

$$\vec{E} = \vec{E}_m \sin(kx - \omega t)$$

$$\vec{B} = \vec{B}_m \sin(kx - \omega t)$$

$$E = Bc \qquad I = \left|\vec{S}_{\text{avg}}\right| = \tfrac{1}{2}\left|\vec{S}_{\text{max}}\right|$$

Fluids

$$p_g = p_a - p_{\text{atm}}$$

$\Delta p = \text{const}$ (Pascal's Principle)

Constants

$$c \approx 3.00 \times 10^8 \text{ m/s}$$

$$p_{\text{atm}} \approx 100\,\text{kPa}$$

$$\rho_{\text{water}} = 1000\,\text{kg/m}^3$$

Geometry

$$A_{\text{circle}} = \pi r^2$$

$$A_{\text{cyl}} = 2\pi r L + 2\pi r^2$$

$$V_{\text{cyl}} = \pi r^2 L$$

$$A_{\text{sphere}} = 4\pi r^2$$

$$V_{\text{sphere}} = \frac{4}{3}\pi r^3$$