

## Phys 273 – Formula Sheet #1

$$F = -kx, \quad U(x) = \frac{1}{2}kx^2, \quad \ddot{x} + \omega_0^2 x = 0, \quad \omega_0 = \sqrt{k/m}, \quad x(t) = Ae^{i(\omega t + \delta)}$$

$$U(x_0 + a) = U(x_0) + U'(x_0)a + \frac{1}{2}U''(x_0)a^2 + \dots,$$

$$\omega_0 = \sqrt{g/l}$$

$$z = x + iy = Ae^{i\theta}, \quad A = \sqrt{x^2 + y^2}, \quad \theta = \tan^{-1}(y/x), \quad x = A \cos(\theta), \quad y = A \sin(\theta)$$

$$e^{i\theta} = \cos(\theta) + i \sin(\theta)$$

$$\ddot{x} + \gamma \dot{x} + \omega_0^2 x = \frac{F_0}{m} e^{i\omega t}, \quad \gamma = b/m, \quad F_{\text{drag}} = -bv = -b\dot{x},$$

$$x(t) = A(\omega)e^{i(\omega t + \delta(\omega))}, \quad A(\omega) = \frac{F_0/m}{\sqrt{(\omega_0^2 - \omega^2)^2 + (\omega\gamma)^2}}, \quad \delta(\omega) = -\tan^{-1}\left[\frac{\omega\gamma}{(\omega_0^2 - \omega^2)}\right]$$

$$\ddot{x} + \gamma \dot{x} + \omega_0^2 x = 0, \quad x(t) = Ae^{-\gamma t/2} e^{i(\omega_d t + \delta)}, \quad \omega_d = \sqrt{\omega_0^2 - \gamma^2/4}$$

$$KE = \frac{1}{2}m\dot{x}^2, \quad U = \frac{1}{2}kx^2,$$

$$U_E = \int \frac{1}{2} \epsilon_0 |\vec{E}|^2 dV = \frac{1}{2}QV = \frac{1}{2}CV^2 = \frac{Q^2}{2C}, \quad U_B = \int \frac{1}{2\mu_0} |\vec{B}|^2 dV = \frac{1}{2}LI^2$$

$$E(t) = E_0 e^{-\gamma t}, \quad Q \equiv \omega_0 / \gamma$$

$$V_R = IR, \quad V_C = \frac{1}{C}Q, \quad V_L = L \frac{dI}{dt}$$

$$Z_R = R, \quad Z_L = i\omega L, \quad Z_C = \frac{-i}{\omega C}, \quad Z_{\text{series}} = Z_1 + Z_2 + \dots, \quad Z_{\text{parallel}} = \frac{1}{Z_1^{-1} + Z_2^{-1} + \dots}$$

$$\vec{V} = \vec{I}Z$$