

PHYS212 EXAM 3 Equation Sheet

Magnetic Force and torque:

$$\vec{F} = q\vec{v} \times \vec{B}, \quad \vec{F} = I\vec{l} \times \vec{B} \text{ (force on wire)}, \quad \vec{\tau} = \vec{\mu} \times \vec{B}, \quad \vec{\mu} = I\vec{A},$$

Faraday's, Ampere, Biot-Savart:

$$V_{emf} = -\frac{d}{dt}\Phi_m, \quad \Phi_m = \int \vec{B} \cdot d\vec{A}, \quad \Phi_m = BA\cos\theta \text{ (simplest case)}$$

$$\int \vec{B} \cdot d\vec{s} = \mu_0 I_{inside}, \quad d\vec{B} = \frac{\mu_0 I d\vec{s} \times \hat{r}}{4\pi r^2}$$

$$B_{wire} = \frac{\mu_0 I}{2\pi r}, \quad B_{loop}(\text{at center}) = \frac{\mu_0 I}{2r}$$

R-L, and R-C circuits:

$$V_{emf} = -L\frac{dI}{dt}, \quad L_{coil} = \frac{\mu_0 N^2 A}{l}, \quad U_B = \frac{1}{2}LI^2, \quad u_B = \frac{1}{2}\frac{B^2}{\mu_0}$$

$$I(t) = I_0 e^{-\frac{R}{L}t} \text{ (discharging)}, \quad I(t) = I_{max}(1 - e^{-\frac{R}{L}t}) \text{ (charging)}$$

$$q(t) = q_0 e^{-\frac{1}{RC}t} \text{ (discharging)}, \quad q(t) = q_{max}(1 - e^{-\frac{1}{RC}t}) \text{ (charging)}$$

L-C circuits:

$$Q = Q_m \cos(\omega t + \phi), \quad I = I_m \cos(\omega t + \phi), \quad \omega = \frac{1}{\sqrt{LC}}, \quad E_{tot} = \frac{1}{2}LI^2 + \frac{1}{2}\frac{Q^2}{C}$$

Right hand rule:

$$\text{thumb} = \text{fingers} \times \text{palm}$$

$$\mu_0 = 4\pi \times 10^{-7} = 1.26 \times 10^{-6} \text{H/m}$$
