**Formulas for Magnetic Fields and AC Circuits**

**Force on a Moving Particle in a Magnetic Field** → \[ \vec{F} = q \vec{v} \times \vec{B} \]

**Current in a Straight Wire** → \[ \vec{F} = I \vec{L} \times \vec{B} \]

**Torque on a Current Carrying Coil in a Magnetic Field** → \[ \vec{\tau} = N A \vec{v} \times \vec{B} \]

**Magnetic Fields Produced by Currents in a Solenoid** → \[ \vec{B} = \mu_0 n I / \pi r \]

**Ampère's Law** → \[ \oint \vec{B} \cdot d\vec{l} = \mu_0 I \text{ around currents} \]

**Motional EMF** → \[ \vec{E} = v \vec{B} \]

**Magnetic Flux** → \[ \Phi = B A \cos \theta \]

**Faraday's Law** → \[ \vec{E} = -\frac{N \Delta \Phi}{\Delta t} \]

**Mutual Inductance** → \[ E_m = -M \frac{I_1}{dt} \]

**Self Inductance** → \[ E = -L \frac{dI}{dt} \]

**Inductance of a Solenoid** → \[ L = \frac{\mu_0 n^2 L}{\pi} \]

**Energy Density in a Magnetic Field** → \[ \frac{E}{V} = \frac{1}{2} \mu_0 B^2 \]

**Transformers** \[ V_s/V_p = N_s/N_p \] and \[ I_s/I_p = N_p/N_s \]

**AC Circuits** → **Impedance** → \[ Z = \sqrt{R^2 + \left(2\pi f L - \frac{1}{2\pi f C}\right)^2} \]

**Resonant Frequency** → \[ f_0 = \frac{1}{2\pi \sqrt{LC}} \]

**Speed of Light** → \[ c = \frac{1}{\sqrt{\varepsilon_0 \mu_0}} \]

**Intensities of Light** → \[ S = \frac{1}{\mu_0} \vec{E} \times \vec{B} = \frac{\text{Power of Light}}{\text{Unit Area}} \]

**Wavelength of Light** → \[ \lambda = \frac{c}{f} \]