PHYS120 Quest 3 Equation Sheet

Ch. 20: Electric Circuits | Ch. 21: Magnetic Forces & Fields

Electric Circuits

Current Definition

$$I = \frac{\Delta q}{\Delta t}$$

Ohm's Law

$$V = IR$$

Power

$$P = IV = I^2R = \frac{V^2}{R}$$

Series Circuits

$$R_{\text{eq}} = R_1 + R_2 + \cdots$$

$$I = \text{same through all components}$$

Parallel Circuits

$$\frac{1}{R_{\text{eq}}} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots$$

$$V = \text{same across each branch}$$

Kirchhoff's Laws

Junction Rule (KCL)

$$\sum I = 0$$

Loop Rule (KVL)

$$\sum V = 0$$

Energy and Power

$$P = \frac{\Delta E}{\Delta t}$$

Magnetic Forces

Force on Moving Charge

$$F = qvB\sin\theta$$

Right-Hand Rule

- Thumb: velocity (or current)
- Fingers: magnetic field
- Palm: force (positive charge)

Force on Current-Carrying Wire

$$F = ILB\sin\theta$$

Magnetic Field of Long Straight Wire

$$B = \frac{\mu_0 I}{2\pi r}$$

Magnetic Field of Loop (at center)

$$B = \frac{\mu_0 NI}{2R}$$

Magnetic Field Inside a Solenoid

$$B = \mu_0 nI \quad (n = N/L)$$

Force Between Parallel Wires

$$\frac{F}{L} = \frac{\mu_0 I_1 I_2}{2\pi r}$$

Circular Motion in Magnetic Field

$$F = \frac{mv^2}{r} = qvB$$

$$r = \frac{mv}{qB}$$

Constants

$$e = 1.60 \times 10^{-19}\,\text{C}$$

$$\mu_0 = 4\pi \times 10^{-7}\,\text{T}\cdot\text{m/A}$$