Electrostatics

$$\vec{F} = K\frac{q_1 q_2}{r^2}\vec{u}_r \qquad \vec{E} = \frac{\vec{F}}{q}$$

$$K = \frac{1}{4\pi\varepsilon_0} = 9\cdot 10^9 (S.I.)$$

$$V_A - V_B = \int_A^B \vec{E}\cdot\vec{dr}$$

$$\vec{E} = K\frac{q}{r^2}\vec{u}_r \qquad V = K\frac{q}{r}$$

$$\int_S \vec{E}\cdot\vec{dS} = \frac{\sum Q}{\varepsilon_0} \qquad W_{AB} = q(V_A - V_B)$$

Conductors and capacitors

$$E = \frac{\sigma}{\varepsilon_0} \qquad C = \frac{Q}{V} \qquad C = \frac{\varepsilon_0 S}{d}$$

$$C_{eq} = \sum C_i \qquad \frac{1}{C_{eq}} = \sum \frac{1}{C_i}$$

$$E_d = \frac{E}{\varepsilon_r} \qquad C_d = \varepsilon_r C$$

$$W = \frac{Q^2}{2C} = \frac{QV}{2} = \frac{V^2 C}{2}$$

Direct Current

$$\vec{J} = n\cdot e\cdot\vec{v}_d \qquad \vec{J} = \sigma\cdot\vec{E}$$

$$R = \frac{V_1 - V_2}{I} \qquad R = \rho\frac{L}{S}$$

$$\rho = \rho_0(1 + \alpha(T - T_0))$$

$$V_A - V_B = I\sum R - \sum\varepsilon$$

$$I = \frac{\sum\varepsilon}{\sum R} \qquad P = V_{AB}\cdot I \qquad \varepsilon = \frac{dW}{dq}$$

$$P_R = R\cdot I^2 \qquad P_g = \varepsilon\cdot I \qquad P_t = \varepsilon'\cdot I$$

$$P_g - P_r = P_s \qquad P_t + P_{r'} = P_c$$

$$\eta_g = \frac{P_s}{P_g} \qquad \eta_r = \frac{P_t}{P_c}$$

Magnetic Forces

$$\vec{F} = q(\vec{v}\times\vec{B}) \qquad d\vec{F} = Id\vec{l}\times\vec{B} \qquad \vec{\mu} = I\cdot\vec{S}$$

$$\vec{\tau} = \vec{m}\times\vec{B} \qquad V_H = \frac{I\cdot B\cdot d}{n\cdot e\cdot S}$$

Sources of Magnetic Field

$$d\vec{B} = \frac{\mu_0}{4\pi}I\frac{d\vec{l}\times\vec{r}}{r^3} \qquad \mu_0 = 4\pi 10^{-7} (S.I.)$$

$$B = \frac{\mu_0 I}{2\pi x} \qquad B = \frac{\mu_0 I}{2R}$$

$$\oint_L \vec{B}\cdot d\vec{l} = \mu_0\sum I \qquad B = \frac{\mu_0 N I}{l}$$

Electromagnetic Induction

$$|\varepsilon| = \frac{d\phi}{dt} \qquad \phi = L\cdot I$$

$$\phi_{21} = M\cdot I_1 \qquad W_L = \frac{1}{2}L\cdot I^2$$

Alternating Current

$$\varphi = \varphi_u - \varphi_i \qquad X_L = L\omega \qquad X_C = \frac{1}{C\omega}$$

$$U_{rms} = \frac{U_m}{\sqrt{2}} \qquad I_{rms} = \frac{I_m}{\sqrt{2}}$$

$$tg\varphi = \frac{L\omega - 1/C\omega}{R}$$

$$Z = \frac{U_m}{I_m} = \sqrt{R^2 + (L\omega - 1/C\omega)^2}$$

$$f_0 = \frac{1}{2\pi}\sqrt{\frac{1}{LC}} \qquad Q = \frac{1}{R}\sqrt{\frac{L}{C}}$$

Semiconductors

$$n\cdot p = n_i^2 \qquad N_A + n = N_D + p$$

$$\vec{v}_n = -\mu_n\vec{E} \qquad \vec{v}_p = \mu_p\vec{E}$$

$$\sigma = q_e(n\mu_n + p\mu_p)$$

$$\vec{J}_{difp} = -q_e D_p \nabla_p \qquad \vec{J}_{difn} = q_e D_n \nabla_n$$