Greatest Hits of Analytical Physics II

Forces on charges due to fields:

$$\vec{F} = q\vec{E} + q\vec{v} \times \vec{B} \qquad \vec{F} = i\,\vec{L} \times \vec{B}$$

Describing E-fields with potentials:

$$\Delta V = -\int_i^f \vec{E} \cdot d\vec{s} \qquad \vec{E} = \left(\frac{\partial V}{\partial x}, \frac{\partial V}{\partial y}, \frac{\partial V}{\partial z} \right) \equiv \vec{\nabla} V$$

Creation of fields by charges and also induction:

$$d\vec{E} = \frac{1}{4\pi\varepsilon_0} \frac{dq}{r^3} \vec{r}$$

Maxwell's Equations

$$\oint \vec{E} \cdot d\vec{A} = \frac{1}{\varepsilon_0} q_{\text{enc}} \qquad \oint \vec{B} \cdot d\vec{A} = 0$$

$$\oint \vec{E} \cdot d\vec{s} = -\frac{d\Phi_B}{dt} \qquad \oint \vec{B} \cdot d\vec{s} = \mu_0 i_{\text{enc}} + \mu_0 \varepsilon_0 \frac{d\Phi_E}{dt}$$

$$\Phi_X \equiv \int \vec{X} \cdot d\vec{A} \qquad d\vec{B} = \frac{\mu_0}{4\pi} i \frac{d\vec{s} \times \vec{r}}{r^3}$$

Energy density due to fields:

$$u_E = \tfrac{1}{2} \varepsilon_0 E^2 \qquad u_B = \tfrac{1}{2} \frac{1}{\mu_0} B^2$$

Equations about waves

$$y = y_m \sin(kx - \omega t + \phi_0)$$

$$\frac{2\pi}{\omega} \equiv T \equiv \frac{1}{f} \qquad \frac{2\pi}{k} \equiv \lambda$$

$$v = f\lambda = \frac{\omega}{k}$$