Lecture 24 (3/14/05)

Magnetostatics

1. Conditions for Magnetostatics

$$\vec{\nabla} \cdot \vec{J} = 0$$

$$\partial_t \vec{B} = 0$$

$$\partial_t \vec{E} = 0$$

Magnetostatic Maxwell system

$$\vec{\nabla} \cdot \vec{E}(\vec{x}) = \rho(\vec{x})$$

$$\vec{\nabla} \times \vec{E} = 0$$

$$\vec{\nabla} \cdot \vec{B} = 0$$

$$\vec{\nabla} \times \vec{B}(\vec{x}) = \vec{J}(\vec{x})$$

Magnetostatic potential equations

$$-\vec{\nabla}^2 A^\nu = J^\nu$$

$$\vec{\nabla} \cdot \vec{A} = 0$$

2. Stoke's theorem

3. Green's function

4. Force between current loops

$$d\vec{B}(\vec{x}) = -\frac{I}{4\pi} \frac{(\vec{x} - \vec{x}') \times d\vec{l'}}{|\vec{x} - \vec{x}'|^3}$$

$$\vec{F}_{12} = \frac{-I_1 I_2}{4\pi} \oint \oint \frac{d\vec{l_1} \cdot d\vec{l_2} (\vec{x}_1 - \vec{x}_2)}{|\vec{x}_1 - \vec{x}_2|^3}$$