PHYSICS 231 – CHAPTER 29: ELECTROMAGNETIC INDUCTION

Emf in closed loop (Faraday's law):

$$\mathcal{E} = \oint \vec{E} \cdot d\vec{l} = -\frac{d\Phi_B}{dt}$$

Emf in moving loop:

$$\mathcal{E} = \oint (\vec{v} \times \vec{B}) \cdot d\vec{l}$$

- straight wire of length L in uniform $\vec{B} \perp \vec{L} \perp \vec{v}$,

$$\mathcal{E} = vBL$$

Maxwell Equations:

- flux through closed surface:

$$\Phi_E = \int \vec{E} \cdot d\vec{A} = \frac{Q_{enc}}{\epsilon_0} \quad , \quad \Phi_B = \int \vec{B} \cdot d\vec{A} = 0$$

- circulation:

$$\oint \vec{B} \cdot d\vec{l} = \mu_0 \left(I_{enc} + \epsilon_0 \frac{d\Phi_E}{dt} \right) \quad , \quad \oint \vec{E} \cdot d\vec{l} = -\frac{d\Phi_B}{dt}$$