PHYSICS 231 – CHAPTER 30: INDUCTANCE

Mutual inductance M:

$$\mathcal{E}_2 = -M\frac{dI_1}{dt} \quad , \quad \mathcal{E}_1 = -M\frac{dI_2}{dt} \quad , \quad M = \frac{N_2\Phi_{B2}}{I_1} = \frac{N_1\Phi_{B1}}{I_2}$$

Self-inductance L:

$$\mathcal{E} = -L\frac{dI}{dt} \quad , \quad L = \frac{N\Phi_B}{I}$$

Energy:

$$U = \frac{1}{2}LI^2$$

Energy density:

- in vacuum

$$u = \frac{B^2}{2\mu_0}$$

- in material of magnetic permeability μ:

$$u = \frac{B^2}{2\mu}$$

$R - L$ circuit:

$$I = \frac{\mathcal{E}}{R}\left(1 - e^{-t/\tau}\right) \quad , \quad \tau = \frac{L}{R}$$

$L - C$ circuit:

$$\omega = \frac{1}{\sqrt{LC}}$$

$L - R - C$ circuit:

$$\omega' = \sqrt{\frac{1}{LC} - \frac{R^2}{4L^2}}$$