**Mutual Inductance:** When a changing current in one coil induces an emf in an adjacent coil

**Inductor:** Coils which induce emf in themselves or other coils

**Inductance:** A coil’s relationship of coil to induced emf, also **self inductance**

**Mutual Inductance**

* Additional interaction occurs when changing current occurs between one of the circuits
* When the current changes, an emf is created in the second coil as well as a current
* Mutual inductance is a proportionality based on the number of turns in a wire
* Induced emf is proportional to the rate of change, not value of the current
* Unit is Henry, 1H = 1Wb/A = 1V x s/A = 1 ohm x sec = 1 J/A^2
* Transformers used in alternating current circuits to raise and lower voltages

**Self Inductance and Inductors**

* Magnetic flux changes when current changes for one inductor as well, creating **self-induced emf**
* The self induced emf opposes change in current, making it more difficult for change in current to occur
* This occurs in any circuit but is more pronounced when there is a coil of wire
* Minus sign in self-induced emf reflects Lenz’s Law, circuit will oppose any change in the current in that circuit.
* The purpose of an inductor is to oppose any variations in current through the circuit
* The field induced within the inductor is not conservative

**Magnetic-Field Energy**

-Establishing current in inductor requires input energy

- Inductor carrying current has energy stored in it

- Energy always flows into a resistor, energy only flows into an inductor when the current in the inductor increases, and it is released when the current decreases

- Energy is stored in the magnetic field of the coil

- Capacitor stores energy in the electric field between its plates

**L-C Circuit**

* An LC circuit creates oscillating current and charge
* Energy is transferred between the capacitors magnetic field, into the inductors magnetic field, and back.
* The derived equation for a capacitor and inductor in series has the same equation as simple harmonic motion
* The total energy in the L-C circuit is constant, it just oscillates between magnetic and electrical forms

**LRC Circuit**

* Some electromagnetic energy is dissipated due to resistance
* If R is small, the circuit will still oscillate (damped harmonic motion)
* It is underdamped if it still oscillates
* When it no longer oscillates, it is critically damped
* Overdamped is for very large resistances