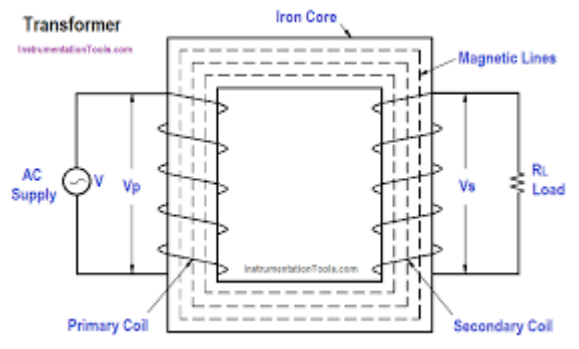
Transformers

Last updated 12/14/21

Transformers

- Basics

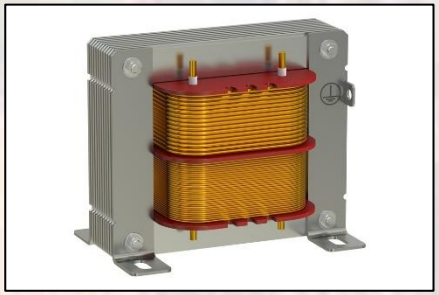
Concept

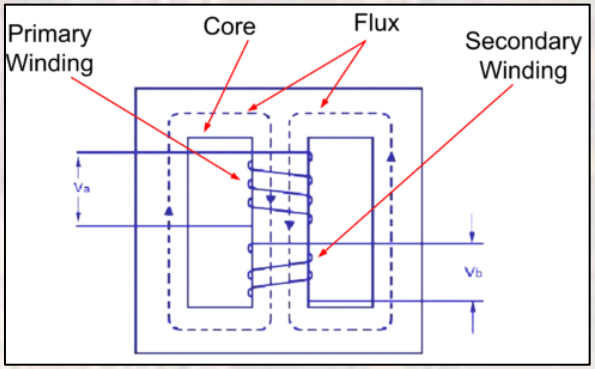


AC voltage on the Primary coil creates a magnetic field (concentrated by the core)

The magnetic field in the core creates a voltage on the secondary coil

Implementation

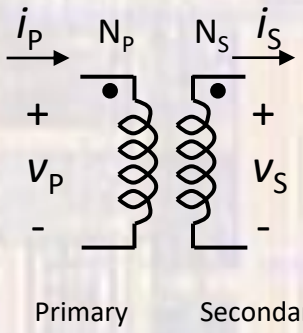




Transformers

- Basics

Schematic



Characteristic Equation

$$\frac{v_P}{v_S} = \frac{i_S}{i_P} = \frac{N_P}{N_S}$$ Transformer turns ratio

Transformers

- Example 1
  - The cube shaped transformer you plug into a wall socket is sometimes called a “wall wart”
  - v_P is approximately 120v rms

What transformer turns ratio would be required to generate an 18v rms secondary voltage

$$\frac{N_1}{N_2} = \frac{v_P}{v_S} = \frac{120v\ rms}{18v\ rms} = 6.66$$

Transformers

- Example 2

How much does the secondary voltage from the previous slide vary due to power line voltage variation

US power line voltage can vary from 114v rms to 126v rms (range A)

$$v_S = \frac{N_2}{N_1} v_P = \frac{1}{6.66} v_P$$

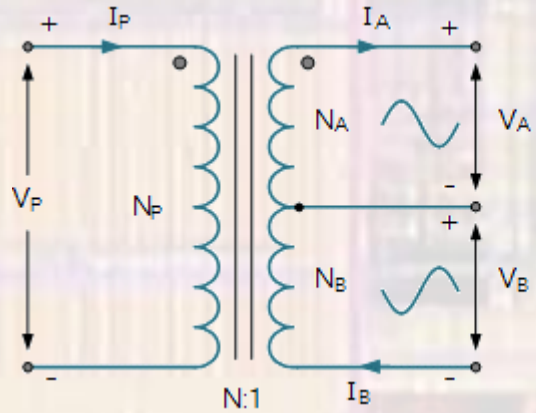
@ 114v rms, v_S = 17.1v rms

@ 126v rms, v_S = 18.8v rms

Note: this is +/- 5%

Transformers

- Center Tap
  - 1 primary coil, 2 secondary coils



$$V_A = \frac{N_A}{N_P} . V_P$$

$$V_B = \frac{N_B}{N_P} . V_P$$