

ECE 111: Handout #16

ECE 331 Energy Conversion

1) Determine the series (R_s , jX_s) and parallel (R_p , jX_p) model for the load (Z)

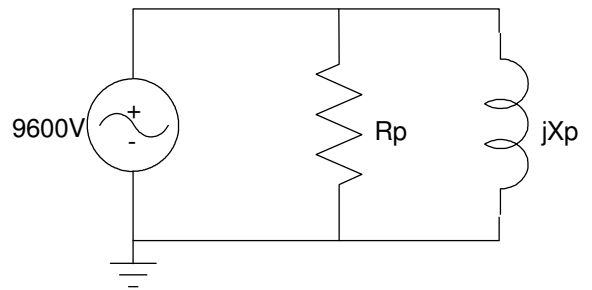
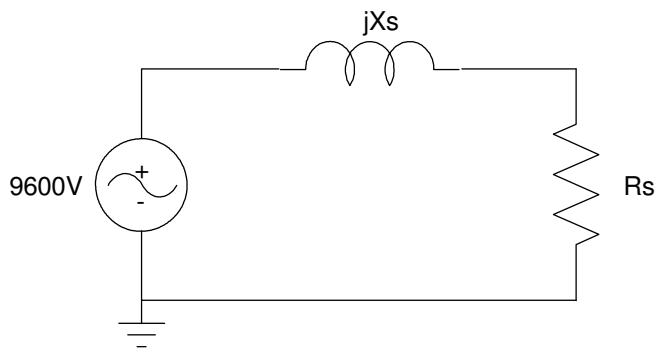
- $V_{in} = 9600V$
- Power = 200 Watts
- $pf = 0.05$

Equations:

$$P = V I pf$$

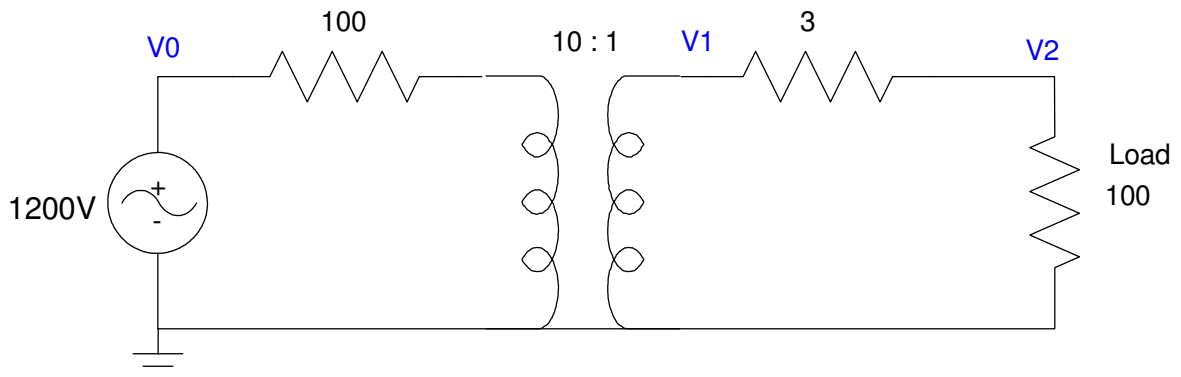
$$Z = \left| \frac{V}{I} \right| \angle \theta$$

$$pf = \cos \theta$$



2) Redraw the circuit as seen by the load (transfer everything to the right side of the transformer)

- Determine the volages and current as seen by the load



Solution

1) Determine the series (R_s , jX_s) and parallel (R_p , jX_p) model for the load (Z)

- $V_{in} = 9600V$
- Power = 200 Watts
- $pf = 0.05$

Equations:

$$P = V \cdot I \cdot pf$$

$$200W = 9600V \cdot I \cdot 0.05$$

$$I = 416.7mA$$

$$Z = \frac{V}{I} \angle \arccos(pf)$$

$$Z = \frac{9600V}{416.7mA} \angle \arccos(0.05)$$

$$Z = 23,040 \angle 87.134^\circ$$

$$Z = 1152 + j23,011 \quad \text{series model}$$

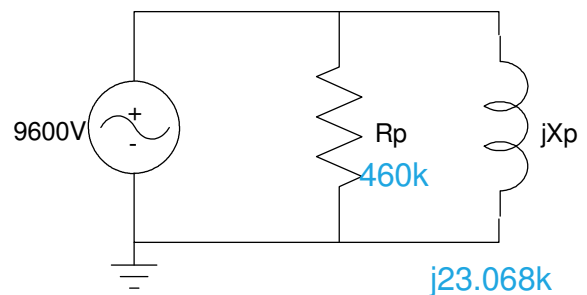
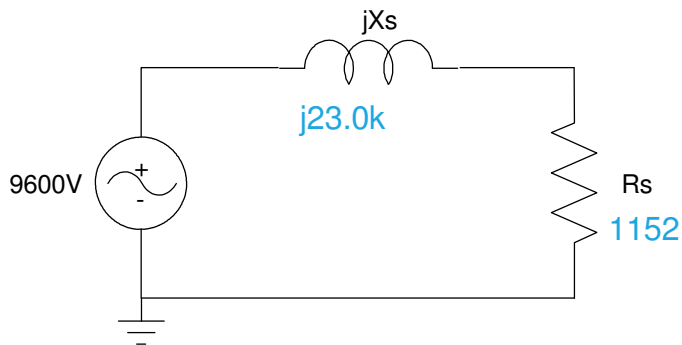
$$R_s = 1152$$

$$jX_s = j23.01k$$

$$\frac{1}{Z} = 2.170 \cdot 10^{-6} - j4.335 \cdot 10^{-5}$$

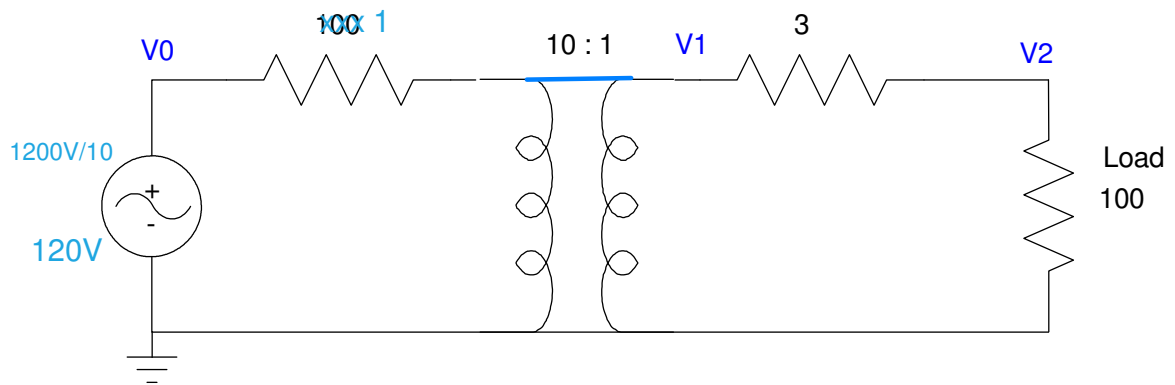
$$R_p = \frac{1}{2.170 \cdot 10^{-6}} = 460k\Omega$$

$$jX_p = \frac{1}{-j4.335 \cdot 10^{-5}} = j23.068k\Omega$$



2) Redraw the circuit as seen by the load (transfer everything to the right side of the transformer)

- Determine the volages and current as seen by the load



By voltage division

$$V_1 = \left(\frac{103}{103+1} \right) 120V = 118.846V$$

$$V_2 = \left(\frac{100}{100+3+1} \right) 120V = 115.385V$$

The current is

$$I = \frac{120V}{104\Omega} = 1.154A$$

Solution