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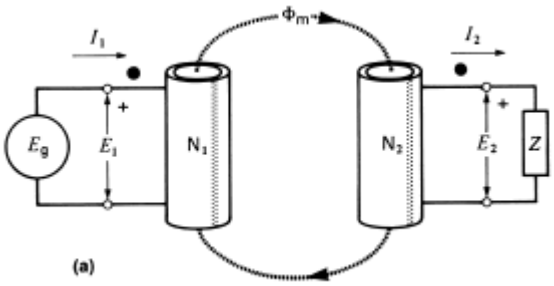
Homework 4: due 2/10/2020

4. The ideal transformer below has 500 turns on the primary and 300 turns on the secondary.



The source produces a voltage $E_g = 600V$ and the load is $Z = 12\Omega$. Calculate

1. The voltage E_2

$$\frac{N_1}{N_2} = a = \frac{E_1}{E_2} \tag{1}$$
$$\frac{500}{300} = \frac{600V}{E_2}$$
$$E_2 = \frac{600V \times 3}{5}$$
$$\underline{\overline{|E_2 = 360V|}}$$

The current I_2

$$I_2 = (\frac{360V}{12\Omega}) \tag{2}$$
$$\underline{\overline{|I_2 = 30A|}}$$

The current I_1

$$\frac{I_2}{I_1} = a \tag{3}$$
$$\frac{3}{5} = \frac{30A}{I_1}$$
$$I_1 = \frac{5 \times 30A}{3}$$
$$\underline{\overline{|I_1 = 50A|}}$$

2. The power delivered to the primary [W]

$$\begin{aligned} P &= IV \\ P &= 50A \times 600V \\ \underline{\overline{|P = 30kW|}} \end{aligned} \tag{4}$$

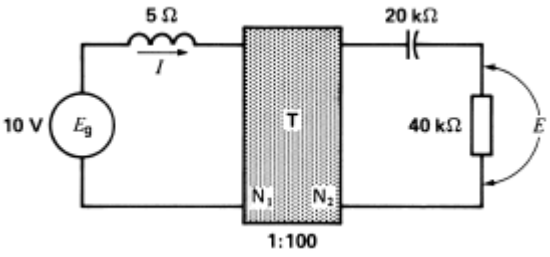
3. The power output from the secondary [W]

$$\begin{aligned} P &= IV \\ P &= 60A \times 360V \\ \underline{\overline{|P = 21.6kW|}} \end{aligned} \tag{5}$$

5. In problem 4, what is the impedance seen by the source E_g?

$$\begin{aligned} R_2 &= a^2 R_1 \\ R_2 &= (\frac{5}{3})^2 \times 12\Omega \\ \underline{\overline{|R = 33\Omega|}} \end{aligned} \tag{6}$$

6. In the circuit below, calculate the voltage across the capacitor and the current flowing through it.



$$\begin{aligned} R_{real} \times a^2 &= R_{observed} \\ 45k\Omega\angle 26^\circ \times (\frac{1}{100})^2 &= R_{observed} \\ R_{observed} &= 4.5\Omega\angle 26^\circ \end{aligned} \tag{7}$$

$$R_s = 4\Omega;\ X_C = 2\Omega;\ X_L = 5\Omega;\ Z_s = 5\Omega\angle 53^\circ$$

$$I = \frac{V}{R}$$

$$I = \frac{10V}{5\Omega\angle 53^\circ}$$

$$I = 4A\angle 53^\circ$$

$$\frac{I_2}{I_1} = \frac{V_1}{V_2} = a$$

$$\frac{I_2}{4A} = \frac{10V}{V_2} = \frac{1}{100}$$

$$\underline{\overline{|V_2 = 1kV;\ I_2 = 40mA|}}$$