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Problem 39.39 (RHK)

A transformer has 500 *primary turns and* 10 *secondary turns.* (a) *We have to find the open circuit secondary voltage* V_s *if the primary voltage* V_p *is* 120 V (*rms*). (b) *Assuming that the secondary is now connected to a resistive load of* $15\ \Omega$, *we have to find the currents in the primary and secondary windings*.

Solution:

The transformer equation is

$$\frac{V_s}{V_p} = \frac{N_s}{N_p},$$

Where N_s is the number of turns in the secondary, and N_p is the number of turns in the primary.

$N_s = 10,$

$N_p = 500,$

$V_p = 120\ \text{V}.$

Therefore,

$$(V_s)_{rms} = \frac{10}{500} \times 120\ \text{V} = 2.4\ \text{V}.$$

When a resistive load of 15 Ω is connected to the secondary, the current in the secondary coil of the transformer will be

$$\left(i_s\right)_{rms} = \frac{\left(V_s\right)_{rms}}{R} = \frac{2.4}{15}\ \text{A} = 0.16\ \text{A}.$$

The current in the primary coil of the transformer can be found by equating the power dissipated in the secondary and the power supplied to the primary coil of the transformer. That is

$$\left(i_p\right)_{rms} \times \left(V_p\right)_{rms} = \left(i_s\right)_{rms} \times \left(V_s\right)_{rms},$$

$$\therefore\ \left(i_p\right)_{rms} = \frac{0.16 \times 2.4}{120}\ \text{A} = 3.2\ \text{mA}.$$