

ECE 3600 homework # 6

b

1. Textbook 1-7

2. Textbook Example 1-2 with
- Mean magnetic length: $l_c := 50\text{-cm}$
- Air gap length: $l_a := 0.06\text{-cm}$
- Core cross-sectional area: $A_c := 16\text{-cm}^2$

Answers 1. 0.0054-Wb 2. 727-mA

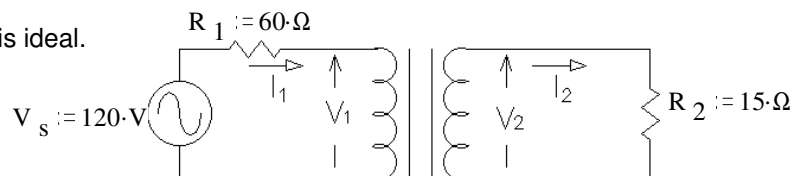
ECE 3600 homework # 7

b

Ideal transformers

1. A step-up transformer is designed to have an output voltage of 2200 V (rms) when the primary is connected across a 240 V (rms) source.
- If there are 150 turns on the primary winding, how many turns are required on the secondary?
 - If a load resistor across the secondary draws a current of 1.2 A, what is the current in the primary, assuming ideal conditions?
2. An ideal transformer has a turns ratio ($N = N_1/N_2$) of 1.5 . It is desired to operate a $200\ \Omega$ resistive load at 150 V (rms).
- Find the secondary and primary currents.
 - Find the source voltage (V_1).
 - Find the power dissipated in the load resistor and the power delivered to the primary from the source.
 - Find the impedance the source sees looking into the primary winding by calculating $Z_{eq} = N^2 Z_L$ and again by calculating V_1 / I_1 .

3. The transformer shown in the circuit below is ideal. It is rated at 120/30 V, 80 VA, 60 Hz Find the following:



- $I_1 = ?$
 - $V_2 = ?$
4. An ideal transformer has a rating of 500/125 V, 10 kVA, 60 Hz. It is loaded with an impedance of $5\ \Omega$ at 80% pf (0.80). The source voltage applied to the primary winding is 440 V (rms). Find:
- the load voltage
 - the load current
 - the kVA delivered to load
 - the power delivered to load
 - the primary current
 - the power factor of primary
 - the impedance the source sees looking into primary.
5. An ideal transformer is rated to deliver 400 kVA at 460 V to a customer.
- How much current can the transformer supply to the customer?
 - If the customer's load is purely resistive (i.e. if the pf = 1), what is the maximum power the customer can receive?
 - If the customer's power factor is 0.8 (lagging), what is the maximum usable power the customer can receive?
 - What is the maximum power if the power factor is 0.7 (lagging)?
 - If the customer requires 300 kW to operate, what is the minimum allowable power factor given the rating of this transformer?

Answers

1. a) 1375 turns b) 11 A 2. a) 0.75 A, 0.50 A b) 225 V c) 112.5 W d) 450 Ω
3. a) 0.4 A b) 24V 4. a) 110 V b) 22 A c) 2.42 kVA d) 1.94 kW e) 5.5 A f) 0.80 g) $80\ \Omega / 36.9^\circ\ \Omega$
5. a) 870 A b) 400 kW c) 320 kW d) 280 kW e) 0.75