ECE 3600   homework # 6

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

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ECE 3600   homework # 7

**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.

   a) If there are 150 turns on the primary winding, how many turns are required on the secondary?

   b) 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).

   a) Find the secondary and primary currents.

   b) Find the source voltage \( V_1 \).

   c) Find the power dissipated in the load resistor and the power delivered to the primary from the source.

   d) 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:

   a) \( I_1 \) = ?

   b) \( V_2 \) = ?

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:

   a) the load voltage

   b) the load current

   c) the kVA delivered to load

   d) the power delivered to load

   e) the primary current

   f) the power factor of primary

   g) the impedance the source sees looking into primary.

5. An ideal transformer is rated to deliver 400 kVA at 460 V to a customer.

   a) How much current can the transformer supply to the customer?

   b) If the customer's load is purely resistive (i.e. if the pf = 1), what is the maximum power the customer can receive?

   c) If the customer's power factor is 0.8 (lagging), what is the maximum usable power the customer can receive?

   d) What is the maximum power if the power factor is 0.7 (lagging)?

   e) 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\( \Omega \)

3. a) 0.4 A  b) 24 V  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° \( \Omega \)

5. a) 870-A  b) 400-kW  c) 320-kW  d) 280-kW  e) 0.75