

Sheet #4

Transformers

- 1- A single phase transformer has **400** primary and **1000** secondary turns. The net cross sectional area of the core is **60cm<sup>2</sup>**. If the primary winding is connected to a 50 Hz supply at **250V**. **Calculate:**
  - a. Peak value of the flux density in the core.
  - b. The induced voltage in the secondary side
  
- 2- A **25 kVA** transformer has **500 turns** on the primary and **50 turns** on the secondary winding. The primary is connected to 3000 V, 50 Hz supply. Find the full load primary and secondary currents, the secondary emf and maximum flux in the core. Neglect leakage drops and no load current. (i.e. consider ideal transformer)
  
- 3- A **250/500 V** transformer gave the following test results:  
S.C. test:  $I_{sc} = 24 \text{ A}$ ,  $V_{sc} = 10 \text{ V}$ , and  $W_{sc} = 100 \text{ W}$   
O.C. test:  $I_o = 1 \text{ A}$ ,  $V_o = 250 \text{ V}$ , and  $W_o = 80 \text{ W}$   
Determine the equivalent circuit parameters and calculate applied voltage and efficiency when the output is 10 A at 500 V and 0.8 p.f. lagging.
  
- 4- A **100 kVA, 6600/330 V, 50 Hz**, 1-phase transformer draws 15.15 A and 900 W at 150 V in a short circuit test while it draws 5 A and 4500 W at 6600 V in an open circuit test. The transformer is loaded with 75% its full load at unity power factor with the secondary voltage 330V. Find the transformer efficiency and voltage regulation.
  
- 5- In a single phase step up transformer whose nominal turns ratio is **110/550**, the following experimental data was obtained from the primary side:  
O.C. test:  
O.C. test:  $V = 220 \text{ V}$ ,  $I = 0.5 \text{ A}$ ,  $W = 19 \text{ W}$   
S.C. test:  $V = 10 \text{ V}$ ,  $I = 20 \text{ A}$ ,  $W = 100 \text{ W}$   
If the transformer is connected to a load of  $(180+j200)\Omega$  with the nominal voltage across the secondary. Find:
  - (a) The primary voltage and current
  - (b) The transformer efficiency
  - (c) The voltage regulation
  
- 6- A **100 kW, 220/110** step down transformer has the following parameters:  
 $R_1 = 0.02 \Omega$ ,  $X_1 = 0.03 \Omega$ ,  
 $R_2 = 0.008 \Omega$ ,  $X_2 = 0.0075 \Omega$ ,  
 $R_0 = 250 \Omega$ ,  $X_0 = 125 \Omega$   
If the transformer is supplying 50% full load at unity power factor and nominal secondary voltage, find:
  - (a) The primary voltage and current
  - (b) The transformer efficiency
  - (c) The voltage regulation

7- The following results are obtained for a 1-phase **200/400 V, 50 Hz** transformer:

O.C test: 200 V, 0.7 A, 70 W

S.C test: 7.5 V, 20 A, 85 W

Calculate primary voltage when the transformer is delivering **5 kW, at 0.8 p.f.** lagging, with nominal voltage across the secondary.

8- A **110/220 V** step up transformer gave the following experimental data in open and short circuit tests:

O.C test: 110 V, 1 A, 20 W

S.C test: 10 V, 40 A, 200 W

If the transformer is connected to a **220 V, 4 kW**, washing machine with a power factor of **0.85 lagging**, find:

(a) The parameters of the transformer ( $Z_{eq}$  &  $Z_0$ )

(b) The primary voltage and current

(c) The transformer efficiency

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