Sheet (2)
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1. 40 KVA, single-phase transformer has 400 turns on the primary and 100 turns on the secondary. The primary is connected to 2000 V, 50 Hz supply. Determine:
   a. The transformation (turns) ratio.
   b. The secondary voltage on open circuit.
   c. The current flowing through the two winding on full-load.
   d. The maximum value of the flux in the core.

2. Prove that the voltage induced per turn in the transformer is the same for primary side and secondary side.

3. A transformer under load was found to deliver 62 A at 220 V when the primary current was 3.2 A. Determine:
   a. Transformation ratio.
   b. The primary input voltage.

4. A 150 KVA, 2400/240 V transformer has the following parameters:
   $R_1 = 0.2\ \Omega$, $R_2 = 0.002\ \Omega$, $X_1 = 0.45\ \Omega$, $X_2 = 0.0045\ \Omega$, $R_m = 10000\ \Omega$, $X_m = 1550\ \Omega$.
   Draw the equivalent circuit referred to:
   a. High voltage side (H.V.S).
   b. Low voltage side (L.V.S).
   Indicate all values of the parameters on the circuit.

5. A 100 KVA, 1100/230 V, 50 Hz transformer has the following parameters:
   $R_1 + JX_1 = 0.1 + J0.4\ \Omega$, $R_2 + JX_2 = 0.006 + J0.1\ \Omega$. Determine:
   a. The equivalent impedance referred to primary side.
   b. The equivalent impedance referred to secondary side.

6. The power input to 440/220 V single-phase transformer on no-load to the high voltage winding is 80 W and power factor of no-load current is 0.3 lagging. Determine:
   a. Active (core loss) component of no-load current.
   b. Reactive (magnetizing) component of no-load current.
   c. No-load current.
   d. Draw the phasor diagram.

7. The primary leakage reactance of a single-phase transformer is 13.2 Ω, and the primary resistance is 1.65 Ω. If the no-load current is 5 A with power factor equal 0.2 lagging and the turns ratio is 5, determine:
   a. The required primary voltage in order that the secondary terminal voltage may be 6600 V at no-load.
   b. Draw the phasor diagram.

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8. A 5 KVA, 50 Hz single-phase transformer is rated at 2200/220 V. The no-load iron loss is 40 W, and the no-load current is 0.3 A. The primary resistance is 5 Ω and the primary leakage reactance is 25 Ω. Determine:
   a. No-load power factor.
   b. No-load secondary voltage if the primary voltage is 2200 V.
   c. Draw the phasor diagram.

9. Referring to problem (4) use the equivalent circuit referred to primary side to determine the primary voltage of transformer at rated load with 0.8 power factor lagging. Draw the phasor diagram.

10. Repeat problem (9) using the approximate equivalent circuit and compare the results then write your comments.

11. Repeat problem (9) using simplified equivalent circuit and compare the results then write your comments. Compare the results in problems 9, 10, 11.

12. Referring to problem (4) use the equivalent circuit referred to primary side to determine the primary voltage of transformer at rated load with 0.8 leading and unity power factor. Draw the phasor diagram in each case.

13. A 100 KVA, 4400/220 V, 50 Hz single-phase transformer has the following parameters: $R_1 = 0.85\ \Omega$, $R_2 = 0.002\ \Omega$, $X_1 = 0.8\ \Omega$, $X_2 = 0.02\ \Omega$. The magnetizing susceptance referred to the H.V side is 0.00025 S and the core loss conductance is 0.000045 S. If the load is such that it takes rated current at rated voltage at secondary terminals and has a power factor of 0.707 lagging determine:
   a. Voltage drops in secondary.
   b. The secondary e.m.f.
   c. The no-load current.
   d. The no-load power factor.
   d. The primary induced e.m.f.
   e. The primary applied voltage and power factor.
   f. Draw the phasor diagram.

14. A 20 KVA, 50 Hz, 2000/200 V distribution transformer has the following parameters:
   leakage impedance of H.V.S winding $Z_1 = 0.24 + J0.25\ \Omega$,
   leakage impedance of L.V.S winding $Z_2 = 0.004 + J0.005\ \Omega$,
   $R_m = 500\ \Omega$, $X_m = 67\ \Omega$. If the voltage applied to the transformer is 2000 V, determine the voltage at the load terminals when the load draw rated current at 0.8 pf lagging. Use the approximate equivalent circuit. Draw the phasor diagram.

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15. A single-phase transformer 3300/400 V has the following winding parameters: R_1 = 0.7 Ω, JX_1 = J3.6 Ω, R_2 = 0.011 Ω, JX_2 = J0.045 Ω. The secondary is connected to a load having a resistance of 4.5 Ω and a reactance of 3.2 Ω. Calculate the secondary terminal voltage, the power consumed by the load and the load power factor when:
    a. The circuit referred to primary side.
    b. The circuit referred to secondary side.

Choose the correct answer:

1. Which of the following does not change in a transformer ?
    a. current. b. voltage.
    c. frequency. d. all of the above.

2. In a transformer the energy is converted from primary to secondary
    a. through cooling coil. b. through air.
    c. by the flux. d. none of the above.

3. A transformer core is laminated to
    a. reduce hysteresis loss. b. reduce eddy current losses.
    c. reduce copper losses. d. reduce all above losses.

4. Which loss is not common between a transformer and rotating machine ?
    a. eddy current loss. b. copper loss.
    c. windage loss. d. hysteresis loss.

5. The no-load current drawn by transformer is usually what percent of the full-load current ?
    a. 0.2 to 0.5 percent. b. 2 to 5 percent.
    c. 12 to 15 percent. d. 20 to 30 percent.

6. The path of the magnetic flux in a transformer should have
    a. high resistance. b. high reluctance.
    c. low resistance. d. low reluctance.

7. The power factor of the transformer at no-load is about
    a. 0.8 lagging. b. 0.7 lagging.
    c. 0.3 leading. d. 0.3 lagging.

8. In an ideal transformer
    a. windings have no resistance. b. core has no losses.
    c. core has infinite permeability. d. all of the above.

9. The main purpose of using core in transformer is to
   a. prevent eddy current losses. b. decrease iron losses.
   c. decrease reluctance of magnetic circuit.
   d. eliminate magnetic hysteresis.

10. A step-up transformer increases
   a. voltage. b. current.
   c. power. d. frequency.

11. Transformer are rated in KVA instead of KW because
   a. load power factor is often known.
   b. KVA is fixed where KW depend on load p.f.
   c. total transformer loss depend on volt-ampere.
   d. it has become customary.

12. In operating a 400 Hz transformer at 50 Hz
   a. only voltage is reduced in the same proportion as the frequency.
   b. only KVA rating is reduced in the same proportion as the frequency.
   c. both voltage and KVA rating are reduced in the same proportion as the frequency.
   d. none of the above.

13. When a 400 Hz transformer is operate at 50 Hz its KVA rating is
   a. reduced to 1/8. b. Increased 8 times.
   c. unaffected. d. increased 64 times.