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Continuing Education Course #532
Electrical Power
Part III: Transformers

1. What term in the transformer model represents the eddy current and hysteresis losses?
 - a. B_c
 - b. G_c
 - c. X_p
 - d. X_s
2. What terms represent flux leakage, that is, flux that is NOT mutual?
 - a. B_c
 - b. G_c
 - c. X_p and X_s
 - d. X_s alone
3. What expression represents the turns ratio, a , when the turns ratio is defined from the primary to the secondary?
 - a. I_p / I_s
 - b. N_s / N_p
 - c. V_p / V_s
 - d. $\sqrt{Z_s / Z_p}$
4. What type of power is used as a rating for transformers?
 - a. S
 - b. P
 - c. Q
 - d. Depends on transformer size
5. What type of loss results from cyclic changes in the magnetic state of the core?
 - a. circulating currents
 - b. eddy current
 - c. hysteresis
 - d. reactive
6. A 500 kVA rated, 200 kg iron-core transformer has a coupling coefficient of 4×10^{-4} in a 1.4 T peak magnetic field.
What is most nearly the eddy current power loss?
 - a. 3.0 W
 - b. 9.0 W
 - c. 400 W
 - d. 570 W

7. A 500 kVA rated, 200 kg iron-core transformer has a coupling coefficient of 4×10^{-4} and a Steinmetz exponent in the technical manual of 1.6.

What most nearly is the hysteresis loss?

- a. 0.1 W
- b. 6.7 W
- c. 8.2 W
- d. 10.1 W

8. A transformer rated operating at 60 Hz is rated at 500 kVA. The core is listed in the data sheets as 200 kg iron, with a coupling coefficient of 4×10^{-4} and a Steinmetz exponent of 1.6 in a 1.4 T peak magnetic field. The primary voltage is 360 kV. The model shows the core resistance as 200 M Ω .

What most nearly are the total core losses?

- a. 180 W
- b. 595 W
- c. 600 W
- d. 650 W

9. A transformer is rated for 34.5 kV. The secondary voltage is measured at no load as 35.02 kV.

What is the percent voltage regulation?

- a. 0.20 %
- b. 1.4 %
- c. 1.5 %
- d. 2.0 %

10. A single-phase transformer rated at 220 V and 0.8 lagging. the primary winding impedance is shown in the data sheet provided as

$$Z_p = R_p + jX_p = 0.012 + j0.020 \text{ pu}$$

What is most nearly the per-unit primary impedance in polar form?

- a. 0.012 pu $\angle 62^\circ$
- b. 0.015 pu $\angle 62^\circ$
- c. 0.02 pu $\angle 62^\circ$
- d. 0.02 pu $\angle 59^\circ$

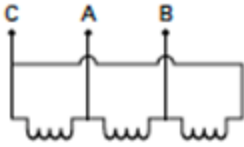
11. When voltage or current ratios are given for a three-phase wye connected transformer, they are assumed to specify what conditions?

- a. line conditions
- b. phase conditions
- c. per the given data sheet
- d. $\sqrt{3}$ times line conditions

12. Of the following, which represent the value in a wye connected three-phase transformer?

- a. $V_l = V_\phi$
- b. $I_l = \sqrt{3} I_\phi$
- c. $I_l = \sqrt{3} V_\phi$
- d. $I_l = I_\phi$

13. What of connection does the following represent?



- a. wye
 - b. delta
 - c. zigzag
 - d. open delta
14. Three-phase delta transformer can lose a single-phase and still provide _____% of their rated load.
- a. 57.7%
 - b. 66.7%
 - c. 68.6%
 - d. 86.6%
15. A three-phase transformer has an output of 220 V and a current rating of 30 A. The power factor rating is 0.8 lagging.

What is most nearly the total power capability of the transformer?

- a. 1.4 kW
 - b. 5.2 kW
 - c. 6.6 kW
 - d. 9.1 kW
16. The type of test that determines the core parameters and the turns ratio is the _____ test.
- a. rated power
 - b. short-circuit
 - c. open-circuit
 - d. maximum power

17. A 13.8 kV single-phase transformer is subjected to an open-circuit test with the following results:

$$P_{in} = 900 \text{ W}$$
$$I_{in} = 0.2 \text{ A}$$
$$V_{out} = 460 \text{ V (secondary)}$$

What is the open-circuit conductance, G ?

- a. 0.07 μS
 - b. 0.96 μS
 - c. 1.96 μS
 - d. 4.73 μS
18. A 13.8 kV single-phase transformer is subjected to an open-circuit test with the following results:

$$P_{in} = 900 \text{ W}$$
$$I_{in} = 0.2 \text{ A}$$
$$V_{out} = 460 \text{ V (secondary)}$$

What is the reactive power, Q ?

- a. 898 VAR
- b. 1123 VAR
- c. 2609 VAR
- d. 2903 VAR

19. A 13.8 kV single-phase transformer is subjected to an open-circuit test with the following results:

$$P_{\text{in}} = 900 \text{ W}$$

$$I_{\text{in}} = 0.2 \text{ A}$$

$$V_{\text{out}} = 460 \text{ V (secondary)}$$

What is most nearly the magnitude of the susceptance, B ?

- a. 2.0 μS
- b. 4.0 μS
- c. 9.0 μS
- d. 13.7 μS

20. A 13.8 kV single-phase transformer is subjected to an open-circuit test with the following results:

$$P_{\text{in}} = 900 \text{ W}$$

$$I_{\text{in}} = 0.2 \text{ A}$$

$$V_{\text{out}} = 460 \text{ V (secondary)}$$

What is most nearly the turns ratio, a ?

- a. 0.03
- b. 0.07
- c. 30
- d. 414

21. A 32 kVA single-phase transformer is rated at 15 kV on the primary. A 60 Hz short-circuit test on the primary resulted in the following reported values.

$$P_{\text{in}} = 1 \text{ kW}$$

$$I_{\text{in}} = 20 \text{ A}$$

$$I_s = 100 \text{ A}$$

$$V_p = 80 \text{ V}$$

Noting that $I_{\text{in}} = I_p = I_{1\text{sc}}$ and $P_{\text{in}} = P_{\text{sc}}$ will aid in the solution. The transformer is designed for maximum efficiency meaning $R_p = a^2 R_s$.

What is the primary resistance?

- a. 0.05 Ω
- b. 1.25 Ω
- c. 2.25 Ω
- d. 2.50 Ω

22. A 32 kVA single-phase transformer is rated at 15 kV on the primary. A 60 Hz short-circuit test on the primary resulted in the following reported values.

$$P_{\text{in}} = 1 \text{ kW}$$

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$$I_s = 100 \text{ A}$$

$$V_p = 80 \text{ V}$$

Noting that $I_{in} = I_p = I_{1sc}$ and $P_{in} = P_{sc}$ will aid in the solution. The transformer is designed for maximum efficiency meaning $R_p = a^2 R_s$.

What is the turns ratio?

- a. 0.05
- b. 0.25
- c. 0.5
- d. 5

23. A short-circuit test is conducted on a transformer rated at 15 kVA and 1200 primary volts.

What is the value of the input current, I_{1sc} ?

- a. 1.25 A
- b. 11.5 A
- c. 12.0 A
- d. 12.5 A

24. What two parameters from the ABCD scheme are associated with the output voltage.

- a. A and B
- b. A and C
- c. B and C
- d. B and D

25. What type of transformer is used to control the voltage or phase angle is both?

- a. Distribution
- b. Instrument
- c. Power
- d. Regulating

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