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Final Exam

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 MΩ.

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. $0.012\,\text{pu} \angle 62^\circ$
- b. $0.015\,\text{pu} \angle 62^\circ$
- c. $0.02\,\text{pu} \angle 62^\circ$
- d. $0.02\,\text{pu} \angle 59^\circ$

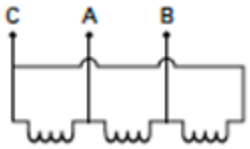
11. When voltage or current ratios are given for a three-phase wye connected transformer, they are assumed to specify what conditions?

- 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 W
I_{in} = 0.2 A
V_{out} = 460 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 W
I_{in} = 0.2 A
V_{out} = 460 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_{in} = 900 W
I_{in} = 0.2 A
V_{out} = 460 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_{in} = 900 W
I_{in} = 0.2 A
V_{out} = 460 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_{in} = 1 kW
I_{in} = 20 A
I_s = 100 A
V_p = 80 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.

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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, $I_{1\text{sc}}$?

- 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