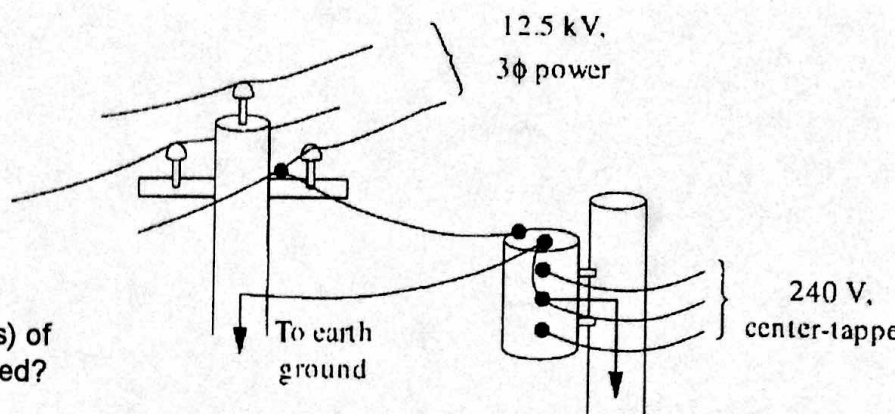


Ideal Transformers WILL be on exam 1

1. The city of Murray, Utah, distributes power to neighborhoods with a 12.47-kV three-phase system. (12.47 kV is the line voltage.) Each group of houses is served from one phase and ground, and transformed to 240/120 V by a pole transformer, as shown.



- What is the turns ratio (primary/secondary turns) of the pole transformer to give 240 V, center-tapped?
 - When a 1500-W toaster-oven is turned on, how much does the current increase in the high-voltage wire? Assume the power factor is unity and the transformer is 100% efficient.
 - Repeat b) for a clothes drier that draws 15 A.
2. A single-phase transformer is designed to operate at 60 Hz. Its voltage ratings are: primary, 500 V; secondary, 200 V. The maximum permissible load is 30 kVA.
- What will be the magnitudes of primary and secondary currents when the device is full-loaded?
 - Loading is accomplished by an impedance connected across the 200-V terminals. How many ohms will correspond to full-load of the transformer? (Use IT model.)
3. 5.3 The 30-kVA transformer of the problem above is made subject to a SC test. One winding is short-circuited and the other winding is fed from a 60-Hz voltage source. The voltage is raised until rated current is circulated in the windings. This occurs when the applied voltage equals 5.11% of rated winding voltage. The transformer consumes 290 W during the test.
- Compute the series impedance $Z_s = R_s + jX_s$ of the transformer referred to primary and secondary sides.
 - Compute the core flux during the SC test. (Express its magnitude in percent of normal operating flux.)
 - Why is it permissible to assume that all of the 290 W constitute ohmic losses in R , and no part of it is core loss?
4. 5.5 The transformer in Exercise 5.3 is fed from a 500-V source. A load impedance of $Z_L = (1.03 + j0.72)\Omega$ is connected across the secondary.
- Find the currents in both windings and the secondary voltage by use of the IT model.
 - Same as in part a) but now include the transformer impedance in your analysis. Take note of the change in your answers.
5. 5.6 The same 30-kVA transformer is made subject to an OC test. It is fed from a 500-V source with the secondary open. The transformer consumes 230 W and draws 0.8 A.
- Find R_m and X_m .
 - Based upon the SC and OC test data compute the efficiency of the transformer when loaded with the Z_L impedance above.

Answers

- 30
 - 208-mA
 - 60-A
 - 150-A
 - $0.0806 + 0.418j\Omega$
 - $0.0129 + 0.0669j\Omega$
 - Because the core flux is 5.11% of normal rated value, the core losses (which are approximately proportional to the square of the flux) are negligible.
 - 63.66 A
 - 159.2 A
 - 61.23 A
 - 153.1 A
 - 1.09 k Ω
 - 0.76 k Ω
 - 97.8 %
- b) 5.11% of normal rated value.
c) Yes, a little