ECE 331 - Homework #2

Transformer Principles

Assume you are designing a power grid to deliver 240V, 60Hz, 10kVA 400km away. The generator produces 138kV.

1) Design a 2400V-240V 100kVA transformer at 60Hz. Assume silicon steel (B = 1.5T, μ_r=7000). Give a model for the transformer you designed including resistance of each winding and core losses.

2) What would the open-circuit and short-circuit V, I, P readings be for this transformer?

3) Design a 13.8kV-2400V 1000kVA transformer at 60Hz. Assume silicon steel (B = 1.5T, =7000). Give a model for the transformer you designed including resistance of each winding and core losses.

4) What would the open-circuit and short-circuit V, I, P readings be for this transformer?

5) Assume the load is 10kVA with a power factor of 1.0. Find the power delivered to the load, the efficiency ignoring the core losses, and the efficiency including the core losses.

6) Assume the load is 10kVA with a power factor of 0.8 lagging. Find the power delivered to the load, the efficiency ignoring the core losses, and the efficiency including the core losses.

7) Find the rms voltage of the following:

- 7a) $v(t) = 200\sin(377t)$
- 7b) $v(t) = 200$
- 7c) v(t) is a 60Hz triangle wave with a peak voltage of 200V.

Lab #1: Last Names A-K this week. Last Names L-Z next week. (There are too many people taking this class for the lab, so we need to do the lab over two weeks: half doing the lab this week, half doint it next week. Turn in the lab with your homework set (no lab write up.)

8-10) Find the parameters for the an actual transformer using a short-circuit and open-circui test.

BONUS! What is the efficiency of a standard 60W incandescent light bulb?