EE 330 Energy Systems (Spring 2012)

Homework 4

Wednesday, February 29, 2012

1) 2-10 Tabulate answers (e.g., column 1 give connection, column 2 high side phase voltage, column 3 low side phase voltage, …). Hint: the given voltages are the line-to-line values coming in/out of the 3-phase transformer.
2) 2-11
3) 2-13ab Should say "Y-Δ connected". Hint: The measured current & voltage are line values measured on the 3ϕ transformer. The measured power is for the entire 3ϕ transformer.
4) 2-19 To ensure that everyone gets consistent results, use the circuit drawing of Fig. 2-41 with terminal *c* omitted on the primary side and the secondary side rotated by 90º clockwise (open side up) and connected to an equivalent balanced Δ-load (i.e., find the equivalent impedance $\bar{Z}_\Delta$ that will draw the correct overall load). This will make the output lines go in order *a*', *c*', *b*' from top to bottom. Further, assume that the primary phase voltage for transformer 1 is at 0 degrees (e.g., $\bar{V}_{an} = V_\phi \angle 0°$) and that the primary phase voltage for transformer 2 is at -120 º (e.g., $\bar{V}_{bn} = V_\phi \angle -120°$). For the <u>primary</u> side, calculate the voltages $\bar{V}_{an}$, $\bar{V}_{bn}$, and $\bar{V}_{ab}$ and currents $\bar{I}_a$, $\bar{I}_b$, and $\bar{I}_n$ (assume currents <u>entering</u> terminals). For the <u>secondary</u> side, calculate the voltages $\bar{V}_{a'b'}$, $\bar{V}_{b'c'}$, and $\bar{V}_{c'a'}$ and currents $\bar{I}_{a'}$, $\bar{I}_{b'}$, and $\bar{I}_{c'}$ (assume secondary currents <u>leaving</u> terminals). For the powers, calculate the powers supplied by each **<u>transformer</u>** P_1, P_2, Q_1, Q_2, S_1, & S_2 as well as the overall supplied powers P_{tot}, Q_{tot}, and S_{tot}.
5) 2.21 To get consistent results, assume that the primary phase voltages are $\bar{V}_{an} = V_{\phi P} \angle 0°$, $\bar{V}_{bn} = V_{\phi P} \angle -120°$, and $\bar{V}_{cn} = V_{\phi P} \angle 120°$. As part of demonstrating the $30°$ lag, find the corresponding line-to-line secondary voltages $\bar{V}_{a'b'}$, $\bar{V}_{b'c'}$, and $\bar{V}_{c'a'}$ in terms of $V_{\phi P}$ and turns ratio *a* of the individual transformers and compare them to the primary line-to-line voltages $\bar{V}_{ab}$, $\bar{V}_{bc}$, and $\bar{V}_{ca}$.

Due Wednesday, March 14, 2012.