Homework #2: Due on Thursday, February 9th Before the Class

Readings: 3.1; 3.3-3.4

2.1 The below single circuit in Figure 2.1 has two ideal transformers,

a). Calculate the load impedance $\mathbf{Z}_{\text{load}}$ seen by the source (not counting the impedance of the line between the source and the transformer)

b). Calculate the current in the middle region between the two transformers. Assume that the line between transformers 1 and 2 has zero impedance.

c) The real and reactive power supplied to the load.

![Figure 2.1 Figure for Problem 2.1](image)

2.2. The below three phase system shown in Figure 2.2 is given with various values of equipment. Starting with a 100 MVA base and a 20 kV voltage base for the generator 1

\textbf{G1}: 20 kV, 90 MVA, $X_{G1} = 0.09$ p.u.

\textbf{T1}: 20 kV/200 kV, 80 MVA, $X_{T1} = 0.16$ p.u.

\textbf{Line 1}: 200 kV, $Z = 0 + j 120$ ohms

\textbf{T2}: 200 kV/20 kV, 80 MVA, $X_{T2} = 0.20$ p.u.

\textbf{G2}: 18 kV, 90 MVA, $X_{G2} = 0.09$ p.u.

\textbf{Load 1}: 200 kV, $Z = 300 + j 400$ ohms
a). Determine the MVA and voltage bases for all appropriate regions

b). Calculate all the appropriate per-unit values and label the values on the one line-diagram.

Figure 2.2 Figure for Problem 2.2

2.3 Consider a three-phase generator rated 300 MVA, 23 kV, supplying a system load of 240 MVA and 0.9 power factor lagging at 230 kV through a 330 MVA, 23Δ/230Y – kV step-up transformer with a leakage reactance of 0.11 pu. (a) Neglecting the exciting current and choosing base values at the load of 100 MVA and 230 kV, find the phasor currents $I_A, I_B,$ and $I_C$ supplied to the load in per unit. (b) By choosing the load terminal voltage $V_A$ as reference, specify the proper base for the generator circuit and determine the generator voltage $V$ as well as the phasor currents $I_a, I_b,$ and $I_c$ from the generator. (Note: take into account the phase shift of the transformer.) (c) Find the generator terminal voltage in kV and the real power supplied by the generator in MW. (d) By omitting the transformer phase shift altogether, check to see whether you get the same magnitude of generator terminal voltage and real power delivered by the generator.