20%
1. For the three-phase, 60-Hz system shown in Fig.1, the leakage reactances of the three-winding transformer are: $X_{ps} = 0.08$ per unit at 50MVA and 13.2kV, $X_{pt} = 0.07$ per unit at 50MVA and 13.2kV, and $X_{st} = 0.20$ p.u. at 20MVA and 2.2kV, where subscripts p, s, and t refer to primary, secondary, and tertiary windings. Using a base of 50,000kVA and 13.2 kV, calculate the various reactances in the circuit and draw the simplified-circuit network.
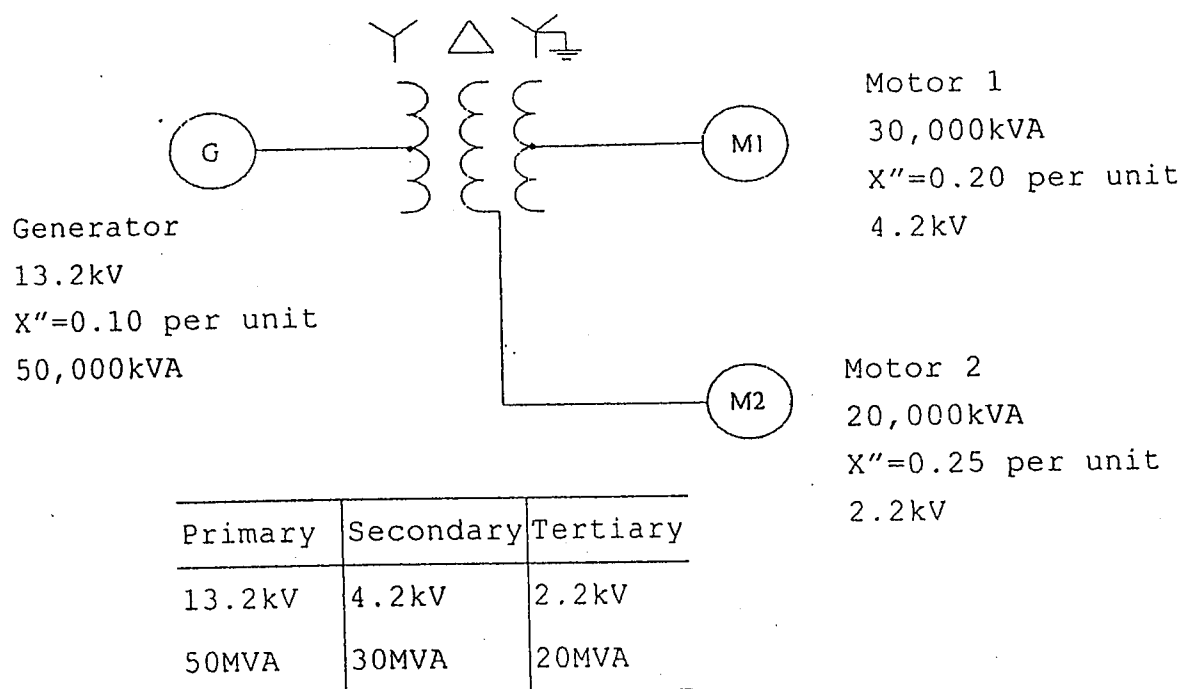

Motor 1
30,000kVA
X"=0.20 per unit
4.2kV

Generator
13.2kV
X"=0.10 per unit
50,000kVA

Motor 2
20,000kVA
X"=0.25 per unit
2.2kV

Primary	Secondary	Tertiary
13.2kV	4.2kV	2.2kV
50MVA	30MVA	20MVA

Fig.1 Three-winding transformer interconnecting motor loads to generator.

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2. Two single-phase transformers are connected in parallel on both the high- and low-voltage sides and have the following characteristics: transformer A, 100kVA, 2300/120 V, 0.006-Ω resistance, and 0.025-Ω leakage reactance referred to the low-voltage side; transformer B, 150 kVA, 2300/115 V, 0.004-Ω resistance, and 0.015-Ω leakage reactance referred to the low-voltage side. A 125-kW load at 0.85 power factor, lagging, is connected to the low-voltage side, with 125 V at the terminal of the transformers. Determine the primary voltage and the current supplied by each transformer.
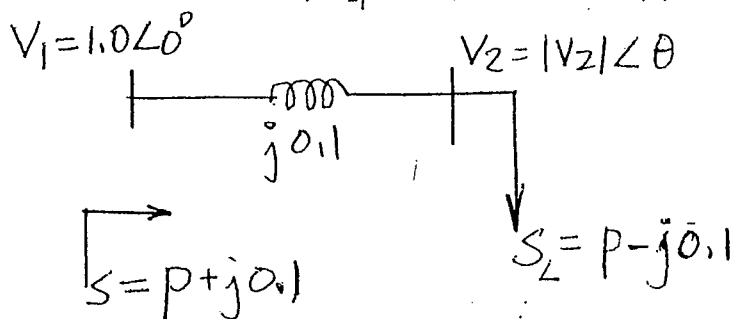
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3. There is a line in a power system as shown in the following figure. Determine (a) θ =? (b) Q_L =? and (c) Q=?

20%

$V_1 = 1.0\angle 0°$　　　$j0.1$　　　$V_2 = 1.0\angle\theta$

$S = 1.0 + jQ$　　　$S_L = P_L + jQ_L$
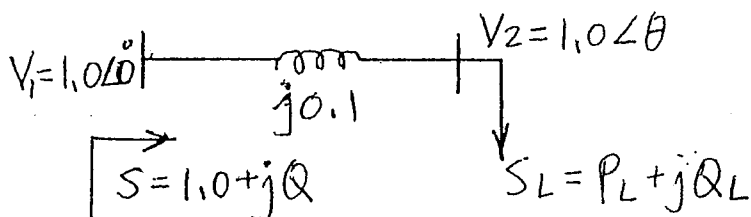
4. A transmission line is selected from a power system as shown in the following figure. Find (a) $|V_2|$ =? (b) θ =? and (c) P=?

20%

$V_1 = 1.0\angle 0°$　　　$j0.1$　　　$V_2 = |V_2|\angle\theta$

$S = P + j0.1$　　　$S_L = P - j0.1$

5. The full-load torque angle of a synchronous motor at rated voltage and frequency is 35 electrical degrees. Neglect the effects of armature resistance and leakage reactance. If the field current is held constant, how would the full-load torque angle be affected by the following changes in operating condition?

20%

a. Frequency reduced 10 percent, load torque and applied voltage constant.

b. Frequency reduced 10 percent, load power and applied voltage constant.

c. Both frequency and applied voltage reduced 10 percent, load torque constant.