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**Faculty of Electrical & Electronics Engineering**
**DEE3143 Basic Electrical Machine & Power Systems**

## ASSIGNMENT #2

1) A transmission line system consists of a generator, a step up transformer, transmission line, a step down transformer and a load. The following components apply to each component. Build the per unit impedance diagram for the power system. Use the base values at generator side:

| | | | | |
|---|---|---|---|---|
| G | : | 130 MVA | 11 kV | $X_G = 16\%$ |
| SUT | : | 135 MVA | 11/132 kV | $X_{SUT} = 15\%$ |
| Line | : | $4 + j12\ \Omega$ | | |
| SDT | : | 125 MVA | 132/11 kV | $X_{SDT} = 11.2\%$ |
| Load | : | 125 MW at unity PF and 11 kV | | |

2) The one-line diagram of a three-phase power system is shown in Figure 1. The manufacturer's data for each device is given as follow:

| | | | |
|---|---|---|---|
| G1: | 50MVA | 20 kV | X=10% |
| M: | 30MVA | 18 kV | X=8% |
| T1: | 30MVA | 20 / 200 kV | X=10% |
| T2: | 30MVA | 200 / 20 kV | X=10% |
| line: | | 200 kV | Z=100+j200Ω |

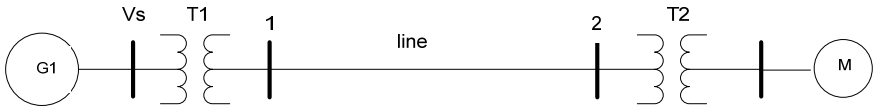


Figure 1

Develop the impedance equivalent diagram for the power system. Mark impedance in per-unit. Select a common base of 50 MVA and 20kV as the voltage base for generator.

3. A 100 MVA, 33 kV, three-phase generator is connected to the motor through a transmission line as shown in Figure 2 below.

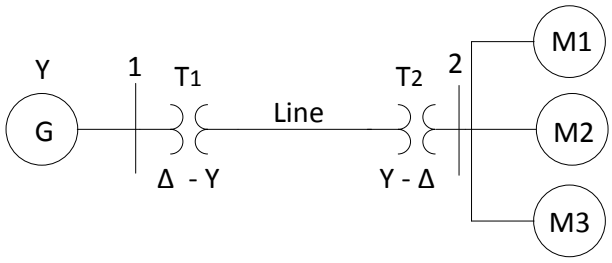


Figure 2

The generator, transmission line and transformers are rated as follows:

| | | | | |
|---|---|---|---|---|
| G | : | 100 MVA | 33 kV | X=15% |
| Three-phase Δ-Y transformer: | | | | |
| $T_1$ | : | 110 MVA | 32Δ /110Y kV | X=8% |
| Three-phase Y-Δ transformer: | | | | |
| $T_2$ | : | 110 MVA | 110Y/32Δ kV | X=8% |
| Three-phase motor: | | | | |
| $M_1$ | : | 40 MVA | 30 kV | X=20% |
| $M_2$ | : | 30 MVA | 30 kV | X=20% |
| $M_3$ | : | 20 MVA | 30 kV | X=20% |
| Line | : | X=60 Ω | | |

Build the per-unit equivalent circuit diagram of the system as shown in Figure 2. Choose the base values in the circuit of generator.

4) Figure 5 shows the schematic diagram of a three phase power system. The network data are given below:

| | | | |
|---|---|---|---|
| G: | 140 MVA | 22 kV | $X_G = 0.28$ pu |
| T1: | 60 MVA | 22/220 kV | $X_{T1} = 0.12$ pu |
| T2: | 60 MVA | 220/11kV | $X_{T2} = 0.09$ pu |
| T3: | 80 MVA | 22/110kV | $X_{T3} = 0.128$ pu |
| T4: | 60 MVA | 110/11kV | $X_{T4} = 0.12$ pu |
| Motor: | 60 MVA | 10.45kV | $X_{Load-1} = 0.167$ pu |

$X_{line1} = 66.62\ \Omega$

$X_{line2} = 88.41\ \Omega$

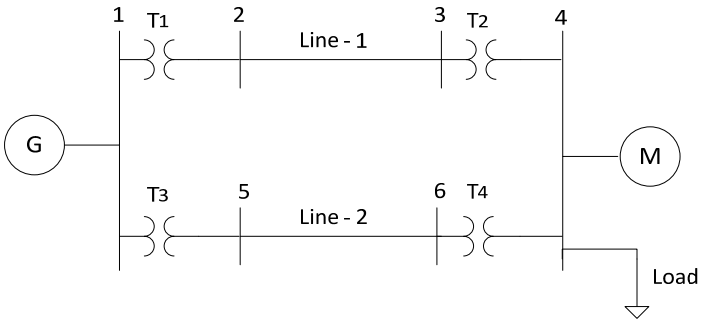


Figure 3

The Load is 55 MVA and it operates at 10.45 kV, 0.75 power factor lagging. By selecting a common base of 100 MVA, and 22kV at generator side, draw the impedance diagram showing all impedances in per unit.

5. The one-line diagram of a three-phase power system is shown in Figure 4. Draw the impedance equivalent circuit for the power system. Mark all impedance in per-unit. Select a common base of 50 MVA and 20 kV at bus 1 near the generator G1.

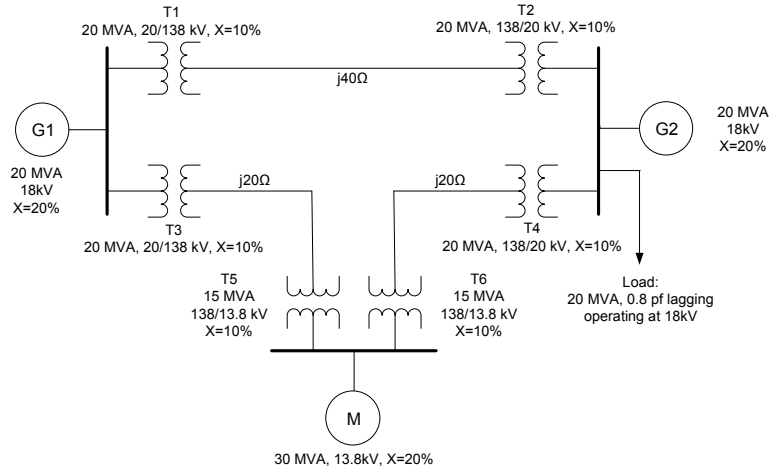


Figure 4