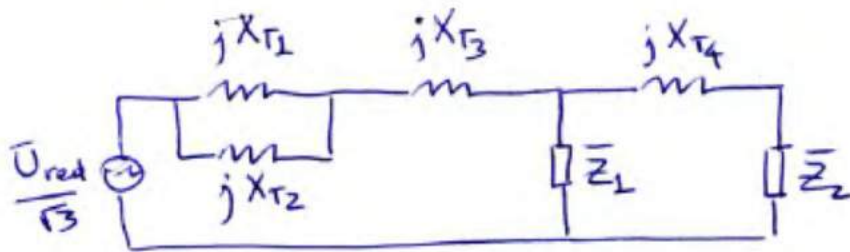


PROBLEMA 1

1)



$$\bar{U}_{red} = 31000 \times \frac{0.23}{31.5} = 226 \text{ V}$$

$$X_{T3} = \frac{.23^2}{3} \times .05 = 0.8817 \text{ m}\Omega$$

$$X_{T1} = \frac{.23^2}{2} \times .1 = 0.002645 \Omega$$

$$X_{T4} = \frac{.23^2}{.5} \times .03 = 0.003174 \Omega$$

$$X_{T2} = \frac{.23^2}{5} \times .1 = 0.001058 \Omega$$

$$\bar{Z}_2 = \frac{440^2 \times .92}{2 \times 10^6} \angle \arccos 0.92 \times \left(\frac{.23}{.44} \right)^2 = 0.02433 \angle 23.07^\circ$$

$$\bar{Z}_2 = \frac{220/\sqrt{3}}{1000} \angle \arccos \frac{370 \times 10^3}{220 \times \sqrt{3} \times 1000} = 0.127 \angle 13.83^\circ$$

$$2) \bar{I}_3 = \frac{\bar{U}_{red}/\sqrt{3}}{\underbrace{jX_{T1} \parallel jX_{T2} + jX_{T3}}_{j0.001637} + \underbrace{(jX_{T4} + \bar{Z}_2) \parallel \bar{Z}_1}_{0.02046 \angle 21.82^\circ}} = 6176 \text{ A} \angle -25.94^\circ$$

$$\frac{3 \times 10^6}{230 \sqrt{3}} = 7530 \Rightarrow |T_3: 82.02\%|$$

$$\frac{7 \times 10^6}{230 \sqrt{3}} = 17571 \Rightarrow |T_1, T_2: 35.15\%|$$

$$\bar{U}_B = \frac{\bar{U}_{red}}{1 + \frac{jX_{T1} \parallel jX_{T2} + jX_{T3}}{(jX_{T4} + \bar{Z}_2) \parallel \bar{Z}_1}} = 218.9 \text{ V} \angle -4.126^\circ$$

$$\bar{I}_4 = \frac{\bar{U}_B/\sqrt{3}}{jX_{T4} + \bar{Z}_2} = 989 \text{ A} \angle -19.34^\circ$$

$$\frac{0.5 \times 10^6}{230 \times \sqrt{3}} = 1255 \Rightarrow |T_4: 78.80\%|$$

$$3) \bar{U}_C = \sqrt{3} \times \bar{Z}_2 \times \bar{I}_4 = 217.5 \text{ V} \angle -5.508^\circ$$

$$\bar{U}_B^{(0.44)} = \bar{U}_B \times \frac{.44}{.23}$$

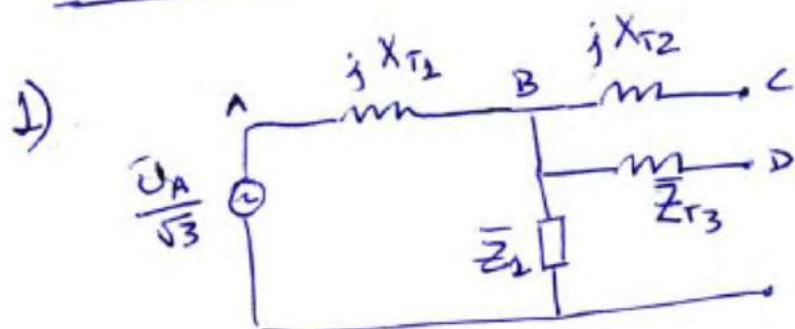
$$\Rightarrow \left| \begin{array}{l} U_C = 217.5 \text{ V} \\ U_B^{(0.44)} = 418.8 \text{ V} \end{array} \right|$$

$$4) \text{ Limita } T_3 \Rightarrow S_{nT_5} = S_{nT_3} = \underline{3 \text{ MVA}}$$

$$X_{eq} = X_{T1} // X_{T2} + X_{T3} = 1.637 \text{ m}\Omega$$

$$X_{T5} = X_{eq} = U_{zT5} \times \frac{.23^2}{3} \Rightarrow U_z = X_{eq} \times \frac{3}{.23^2} = \underline{9.284\%}$$

PROBLEMA 2



$$\bar{U}_A = \frac{14.5 \times 6.3 \text{ kV}}{15} = 6090 \text{ V}$$

$$X_{T1} = \frac{6.3^2}{1} \times .1 = 3.969 \Omega$$

$$X_{T2} = \frac{6.3^2}{.5} \times .05 = 3.969 \Omega$$

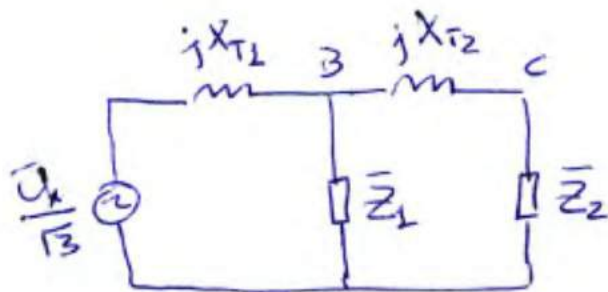
$$\bar{Z}_{T3} = \frac{300}{\sqrt{3} \times 9} \angle \arccos \frac{500}{9 \times 300 \times \sqrt{3}} = 19.25 \Omega \angle 83.86^\circ$$

$$\bar{Z}_L = \frac{6100}{\sqrt{3} \times 9.5} \angle \arccos \frac{95000}{6100 \times \sqrt{3} \times 9.5} = 370.7 \Omega \angle 18.83^\circ$$

$$2) \bar{U}_B = \frac{\bar{U}_A}{1 + j \frac{X_{T1}}{\bar{Z}_L}} = 6074 \text{ V} \angle -5.941^\circ, \underline{\bar{U}_B = 6074 \text{ V}}$$

$$\bar{U}_C = \frac{.4}{6.3} \times U_B = \underline{385.7 \text{ V}}, \bar{U}_D = \frac{.38}{6.3} \times U_B = \underline{366.4 \text{ V}}$$

$$3) \bar{Z}_2 = \frac{.38^2}{.275} \times \left(\frac{6.3}{.4} \right)^2 \angle \arccos 0.9 = 130.3 \Omega \angle 25.84^\circ$$



$$\bar{U}_B = \frac{\bar{U}_A}{1 + \frac{jX_{T1}}{\bar{Z}_1 // (jX_{T2} + \bar{Z}_2)}} = 5983V \angle -2.073^\circ$$

$0.04067 \angle 64.83^\circ$

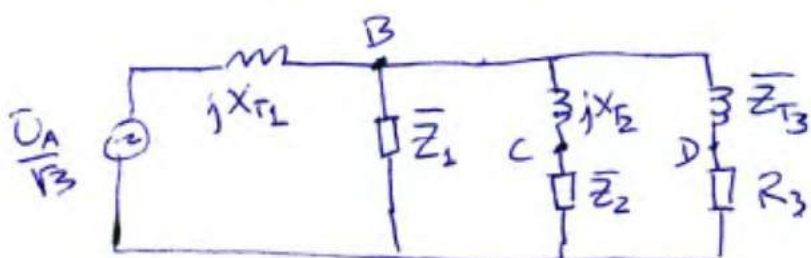
$$\bar{U}_C = \frac{\bar{U}_B}{1 + \frac{jX_{T2}}{\bar{Z}_2}} = 5902V \angle -3.622^\circ$$

$$|U_B| = 5983V$$

$$|U_C^{(baja)}| = 374.7V$$

$$\bar{U}_D = \bar{U}_B \quad |U_B^{(baja)}| = 360.9V$$

4) $R_3 = \frac{380^2}{96000} \times \left(\frac{6.3}{.38}\right)^2 = 413.4 \Omega$



$$\bar{U}_B = \frac{\bar{U}_A}{1 + \frac{jX_{T1}}{\bar{Z}_1 // (jX_{T2} + \bar{Z}_2) // (\bar{Z}_3 + R_3)}} = 5978V \angle -2.608^\circ$$

$0.04962 \angle 69.08^\circ$

$$|U_B| = 5978V$$

$$\bar{U}_C = \frac{\bar{U}_B}{1 + \frac{jX_{T2}}{\bar{Z}_2}} = 5897V \angle -4.158^\circ, \quad |U_C^{(baja)}| = 374.4V$$

$$\bar{U}_D = \frac{\bar{U}_B}{1 + \frac{\bar{Z}_3}{R_3}} = 5942V \angle -5.246^\circ, \quad |U_D^{(baja)}| = 358.4V$$

$$I_{N1} = \frac{10^6}{6300\sqrt{3}} = 91.64A, \quad I_{N2} = \frac{500}{6.3\sqrt{3}} = 45.82A, \quad I_2 = \frac{(\bar{U}_B - \bar{U}_C)/\sqrt{3}}{jX_{T2}} = 26.16A \angle -30.4^\circ$$

$$I_{N3} = 300/(6.3\sqrt{3}) = 27.49A, \quad I_3 = \frac{\bar{U}_B - \bar{U}_D}{\sqrt{3}\bar{Z}_3} = 8.3A \angle -52.6^\circ$$

$$I_L = \frac{(\bar{U}_A - \bar{U}_B)/\sqrt{3}}{jX_{T1}} = 43.14A \angle -23.49^\circ$$

$|T_1: 47.08\%| \quad |T_3: 30.19\%|$