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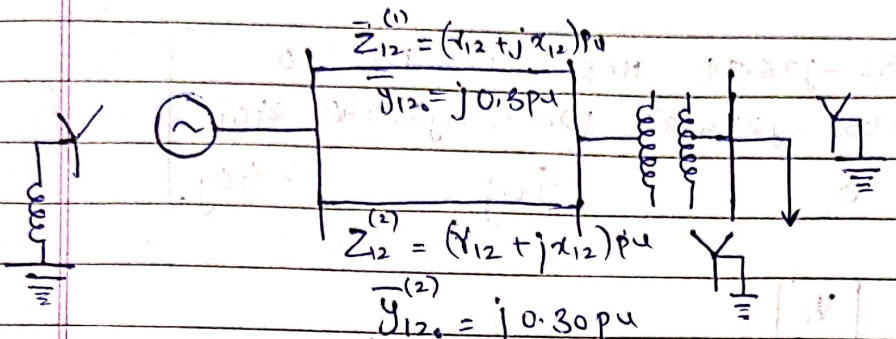

a] $\bar{V}_1 = 1.0\angle 0°$ pu , $\bar{V}_2 = 0.98\angle -2°$ pu.

$\bar{V}_3 = \frac{1}{1.03}\bar{V}_2$, $= 0.95\angle -2$ pu

$$Y_{11} = \frac{1}{Z_{12}} + \frac{1}{Z_{12}} + \frac{1}{j0.3}$$

$$= \frac{2}{Z_{12}} + \frac{1}{j0.3} = \frac{2}{0.032 + j0.071} + \frac{1}{j0.3}$$

$$= 10.552 - j26.74$$

$$Y_{12} = \frac{1}{Z_{12}} \times 2 = \frac{1 \times 2}{0.032 + j0.071} = 10.552 - j23.413$$

$$Y_{22} = \frac{1}{Z_{12}} + \frac{1}{Z_{12}} + \frac{1}{j0.3} + \frac{1}{j0.025}$$

$$= 10.5523 - j66.7463$$

$$Y_{23} = \frac{1}{j0.025} = -j40.$$

$$Y_{33} = -j40$$

$$Y_{13} = 0.$$

Page No.
Date

11908080120

$$Y_{bus} = \begin{bmatrix} 10.552 - j26.74 & 10.552 - j28.413 & 0 \\ -(10.552 - j23.413) & 10.552 - j66.746 & 40j \\ 0 & 40j & -40j \end{bmatrix}$$

$$\begin{bmatrix} I_1 \\ I_2 \\ I_3 \end{bmatrix} = Y_{bus} \begin{bmatrix} V_1 \\ V_2 \\ V_3 \end{bmatrix}$$

$$= Y_{bus} \begin{bmatrix} 1 \\ 0.979 - j0.034 \\ 0.949 - j0.033 \end{bmatrix}$$

$$= \begin{bmatrix} - 2.038918 - j26.30726 \\ -1.17085 - j4.327 \\ 0.04 + j1.2 \end{bmatrix}$$

$$\bar{I}_{21} = \frac{\bar{V}_2 - \bar{V}_1}{\bar{Z}_{12}} + \frac{\bar{V}_2 \bar{y}_{12}}{2}$$

$$= 5.2567 - 11.657j$$

$$= 12.553 \angle -67.$$

$$= 0.5604 \angle 151.99^\circ \text{ pu}$$

$$\bar{I}_{23} = -2 \times \bar{I}_{21} = 1.1207 \angle -28.006^\circ \text{ pu}$$

$$V_3' = \frac{V_2}{1.03} = 0.9514 \angle -2^\circ$$

$$\bar{V}_3 = \bar{V}_3' - I_{23} \times j0.025 = 0.9895 \angle -3.535 \text{ pu}$$

$$S_3 = \bar{V}_3 I_3^* = (0.958 + j0.436) \text{ pu}$$

Active power = 0.958pu

Reactive power = 0.436pu

Page No.
Date

119EE0820

b) active power 20%.

bus 1 → Slack
bus 2 → P, Q
bus 3 → PQ

Ybus matrix.

	1	2	3
1	10.552 − j26.74	10.552 − 23.48j	0
2	−10.552 + j23.413	10.852 −j66.7463	j40
3	0	j40	−40j

$$\begin{matrix} 2 \\ 3 \end{matrix}\begin{bmatrix} 10.552 - j23.48 & 10.552 - j66.7463 \\ 0 & j40 \end{bmatrix}.$$

$$y_{12} = \frac{1}{0.025j} = -40j.$$

$\bar{V}_2 = 0.98\angle -2^\circ$

$\bar{V}_3 = 0.9399\angle -38.21^\circ$

$\bar{V}_1 = 1\angle 0^\circ$

$$\begin{matrix} P_2 \\ P_3 \end{matrix}\begin{bmatrix} -B_{22} & -B_{23} \\ -B_{32} & -B_{33} \end{bmatrix}\begin{bmatrix} \Delta\delta_2 \\ \Delta\delta_3 \end{bmatrix} = \begin{bmatrix} \Delta P_2/V_2 \\ \Delta P_2/V_3 \end{bmatrix}$$

Ignoring contribution of iff nonn transformer. $a = 1\angle 0^\circ \begin{bmatrix} -40j & 40j \\ 40j & -40j \end{bmatrix}$.

$$B' = \begin{bmatrix} 81.8085 & -40 \\ -40 & 40 \end{bmatrix}.$$