Chapter 11.

11.2 (a) for ~~parallel~~, $\cancel{Y' = Y_A + Y_B}$ & $Z_B \to 0$.

$\cancel{\frac{1}{Z'} = \frac{1}{Z_A} + \frac{1}{Z_B}}$ $\Rightarrow \frac{1}{Z_B} \to \infty$

$\boxed{\cancel{Z' = Z_A}}$

if $I_1 = 0 \Rightarrow I_2 = 0 \Rightarrow$ cannot calculate Z matrix.

a

$Y_{11} = \frac{I_1}{V_1}\Big|_{V_2=0} = \frac{1}{Z_1}$ & $Y_{22} = \frac{I_2}{V_2}\Big|_{V_1=0} = \frac{1}{Z_1}$

$Y_{21} = \frac{I_2}{V_1}\Big|_{V_2=0} = \frac{-1}{Z_1}$, $Y_{12} = \frac{I_1}{V_2}\Big|_{V_1=0} = \frac{-1}{Z_1}$

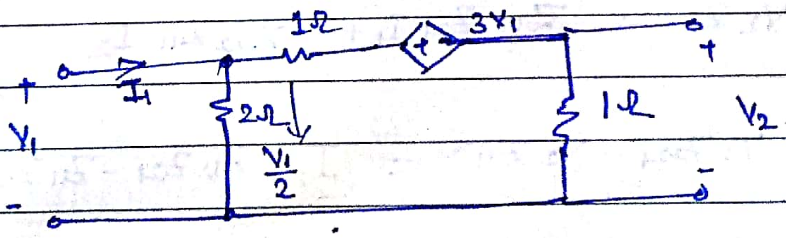
b

$V_1 = 0 \Rightarrow V_2 = 0 \Rightarrow$ dosent exist.

$\cancel{Z_{11} = \frac{V_1}{I_1}\Big|_{I_2=0} = \frac{1}{Y_2} = Z_{22}}$

$Z_{12} = \frac{V_1}{I_2}\Big|_{I_1=0} = \frac{1}{Y_2} = Z_{21}$

11.6



$Z_{11} = \frac{V_1}{I_1}\Big|_{I_2=0}$ $(I_1 - \frac{V_1}{2})$ V_1

$V_1 - (I_1 - \frac{V_1}{2}) - 3V_1 = V_2$

$\boxed{\cancel{Z_{11} = 2/3}}$

$V_1 - 2(I_1 - \frac{V_1}{2}) - 3V_1 = 0$

$2V_1 = -2I_1 + \frac{2V_1}{2}$

$V_1 = -2I_1$

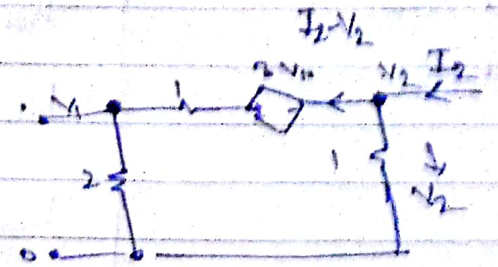
$2V_1 = 2(I_1 - \frac{V_1}{2})$

$\frac{3V_1}{2} = I_1$

$\frac{V_1}{I_1} = 2/3$

$\boxed{Z_{11} = -2}$

$$Z_{12} = \left.\frac{V_1}{I_2}\right|_{I_1=0}$$



$$V_2 + 3V_1 - (I_2 - V_2) = V_1$$

$$V_2 + 3V_1 - I_2 + V_2 = V_1$$

$$\underline{\underline{2V_2 + 2V_1 = I_2}}$$

$$2I_2 - V_1 + 2V_1 = I_2$$

$$2I_2 + V_1 = I_2$$

$$V_1 = -I_2$$

$$\frac{V_1}{I_2} = -1$$

$$\boxed{Z_{12} = -1}$$

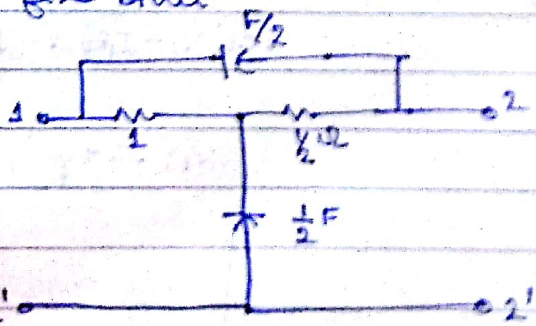
$$V_1 = 2(I_2 - V_2)$$

$$\frac{V_1}{2} = I_2 - V_2$$

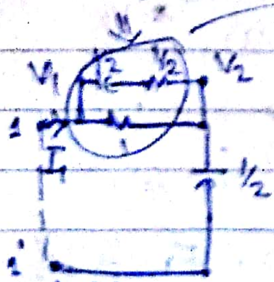
$$V_2 = I_2 - \frac{V_1}{2}$$

Similarily find other.

11.10



$$Z_{11} = \left.\frac{V_1}{I_1}\right|_{I_2=0}$$



$$Z_{eq} = \frac{\left(\frac{1}{2s} + \frac{1}{2}\right)\cdot 1}{\frac{1}{2s} + \frac{3}{2}} = \frac{\frac{1}{2}\left(\frac{1}{s}+1\right)}{\frac{1}{2}\left(\frac{1}{s}+3\right)}$$

$$= \frac{s+1}{3s+1}$$

$$V_1 - I_1\left(\frac{s+1}{3s+1}\right) = V_2$$

$$V_2 - \frac{I_1}{2s} = 0$$

$$V_1 - I_1\left(\frac{s+1}{3s+1}\right) = \frac{I_1}{2s}$$

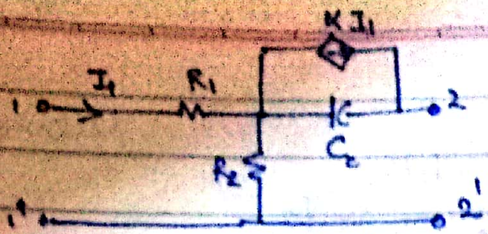
$$V_1 = I_1\left(\frac{1}{2s} + \frac{s+1}{3s+1}\right)$$

$$\frac{V_1}{I_1} = \frac{(3s+1) + 2s^2 + 2s}{2s(3s+1)}$$

$$\boxed{Z_{11} = \frac{2s^2 + 5s + 1}{6s^2 + 2s}}$$

similarily others

11.14



$h_{11} = \frac{V_1}{I_1}\Big|_{V_2=0}$

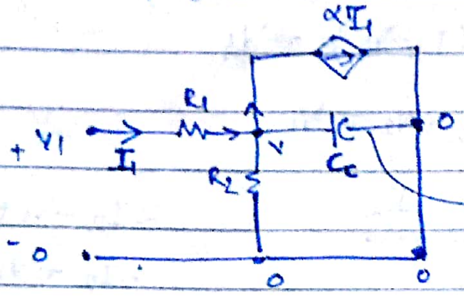
$h_{21} = \frac{I_2}{I_1}\Big|_{V_2=0}$

$h_{12} = \frac{V_1}{V_2}\Big|_{I_1=0}$

$h_{22} = \frac{I_2}{V_2}\Big|_{I_1=0}$

h parameters

$h_{11} = \frac{V_1}{I_1}\Big|_{V_2=0}$



$I' = I_1 - \alpha I_1 - \frac{V}{R_2}$

$\frac{V_1 - V}{R_1} = I_1$

$I' = I_1 - \alpha I_1 - \frac{(V_1 - I_1 R_1)}{R_2}$

$V_1 - V = I_1 R_1$

$\boxed{V = V_1 - I_1 R_1}$

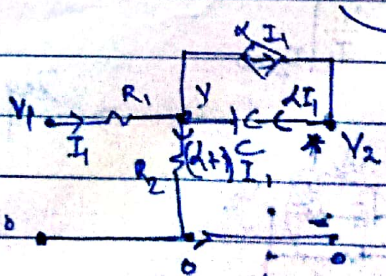
$(V_1 - I_1 R_1) - \frac{\left(I_1 - \alpha I_1 - \frac{V_1}{R_2} + \frac{I_1 R_1}{R_2}\right)}{sC} = 0$

$sC(V_1 - I_1 R_1) = I_1\left(1 - \alpha + \frac{R_1}{R_2}\right) - \frac{V_1}{R_2}$

$V_1\left(sC + \frac{1}{R_2}\right) = I_1\left(1 - \alpha + \frac{R_1}{R_2} + R_1 sC\right)$

$$h_{11} = \boxed{\frac{V_1}{I_1} = \frac{1 - \alpha + \frac{R_1}{R_2} + R_1 sC}{sC + \frac{1}{R_2}}}$$

$g_{11} = \frac{I_1}{V_1}\Big|_{I_2=0}$



$(\alpha+1)I_1 = \frac{V_1 - I_1 R_1}{R_2}$

$V = V_1 - I_1 R_1$

$\cancel{V_1 = I_1 R_1}$ $(\alpha+1)I_1 = \frac{V_1}{R_2} - \frac{I_1 R_1}{R_2}$ $\quad sC(V - V_2) = I_1 - \frac{V}{R_2} - \alpha I_1$

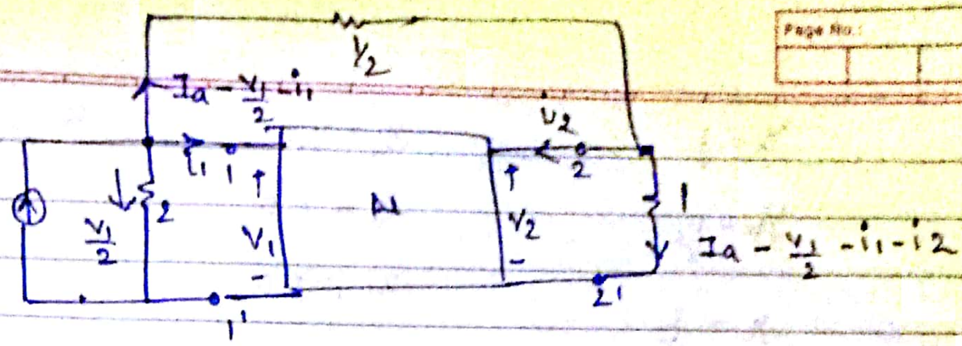
$\cancel{V - \left(I_1 - \frac{V}{R_2} - \alpha I_1\right) \cdot \frac{1}{sC} = V_2}$

$I_1\left(\alpha + \frac{R_1}{R_2} + 1\right) = \frac{V_1}{R_2}$

$$\boxed{g_{11} = \frac{I_1}{V_1} = \frac{1}{\alpha R_2 + R_1 + R_2}}$$

Similarily others.

11.16



since we know

$$\begin{pmatrix} i_1 \\ i_2 \end{pmatrix} = \begin{pmatrix} y_{11} & y_{12} \\ y_{21} & y_{22} \end{pmatrix} \begin{pmatrix} V_1 \\ V_2 \end{pmatrix}$$

$$V_1 - \frac{1}{2}\left(I_a - \frac{V_1}{2} - i_1\right) = V_2$$

$$\begin{pmatrix} i_1 \\ i_2 \end{pmatrix} = \begin{pmatrix} 2 & 1 \\ 2 & 2 \end{pmatrix} \begin{pmatrix} V_1 \\ V_2 \end{pmatrix}$$

$$V_2 = I_a - \frac{V_1}{2} - i_1 - i_2 \quad \text{— (D)}$$

$I_a = 1$

$$i_1 = 2V_1 + V_2 \quad \text{— (A)}$$

$$i_2 = 2V_1 + 2V_2 \quad \text{— (B)}$$

$$V_1 - \frac{1}{2}\left(1 - \frac{V_1}{2} - i_1\right) = V_2 \quad \text{— (C)}$$

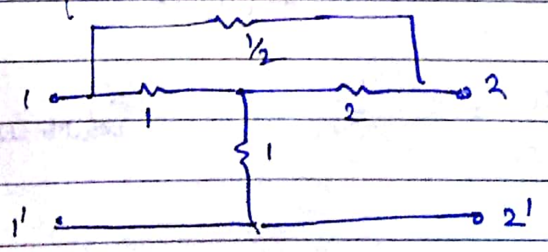
$$V_2 = 1 - \frac{V_1}{2} - i_1 - i_2 \quad \text{— (D)}$$

4 eq. 4 variables

11.23 Yes!

because in second we can easily apply Norton, thevenin to find parameters.

11.26



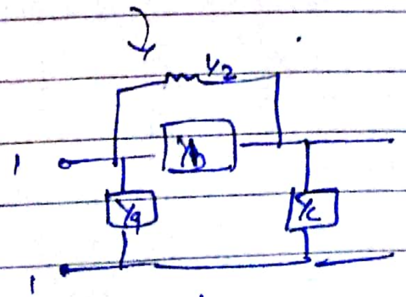
$Z_1 = 1$, $Z_2 = 1$, $Z_3 = 2$

$D = 1 + 2 + 2 = 5$

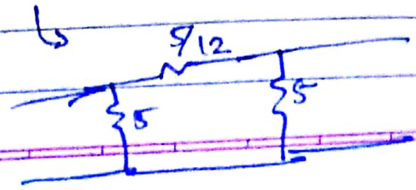
$Y_a = \frac{1}{5}$

$Y_b = \frac{2}{5}$

$Y_c = \frac{1}{5}$



$$\frac{\frac{5}{2} \cdot \frac{1}{2}}{3} = \frac{5}{12}$$



equivalent π network

$Y_a = \frac{1}{5}$

$Y_b = \frac{12}{5}$

$Y_c = \frac{1}{5}$

$Z_2 = Y_a D$

$Z_3 = Y_b D$

$Z_1 = Y_c D$

$\Rightarrow D = Z_1 Z_2 + Z_2 Z_3 + Z_3 Z_1$

$\frac{D}{D^2} = Y_a Y_c + Y_a Y_b + Y_b Y_c$

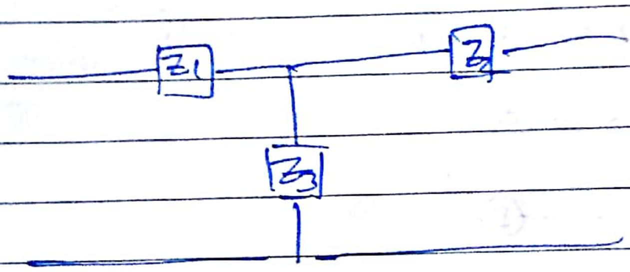
$\frac{1}{D} = \frac{1}{25} + \frac{12}{25} + \frac{12}{25}$

$\frac{1}{D} = 1 \Rightarrow D = 1$

$Z_2 = Y_a$

$Z_3 = Y_b$

$Z_1 = Y_c$



eq. T network

24, 25, 27, 28 all similar to $\underline{\underline{26}}$. (T-π transformation)

$\underline{\underline{Q:35}}$ $G_{12} = \frac{Z_{21}}{Z_{11}}$, $Z_{21} = \left.\frac{V_2}{I_1}\right|_{I_2=0}$, $Z_{11} = \left.\frac{V_1}{I_1}\right|_{I_2=0}$ } $I_2 = 0 \Rightarrow$ port 2 open (as required)

$G_{12} = \frac{V_2/I_1}{V_1/I_1} = \frac{V_2}{V_1}$ which is true.