

تبدیل

$$H_b = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$\frac{V_4}{Z_2} = \frac{1}{4} = 0$$

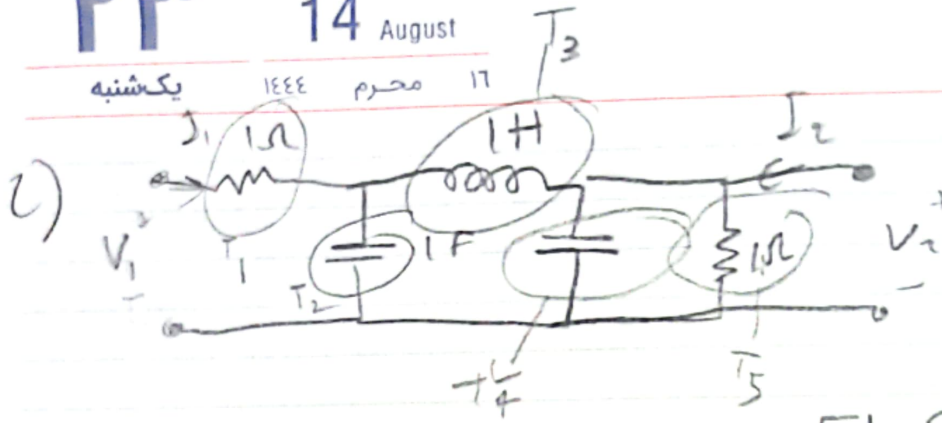
$$\begin{aligned} i_3 &= \frac{V_3}{4} = V_3 \\ V_4 &= V_3 + \frac{1}{4} = V_3 \end{aligned} \quad \Rightarrow \quad i_3 = \frac{V_4}{4} = V_3$$

$$\begin{aligned} V_2 &= -i_3 = -V_3 \\ V_3 &= -i_2 \end{aligned} \quad \Rightarrow \quad \begin{aligned} i_2 &= -i_3 = V_2 = -V_3 \\ i_2 &= -i_3 = V_2 = -V_3 \end{aligned}$$

$$V_1 = i_1 = V_2 = -V_3$$

$$-i_2 = i_1 = V_3$$

$$Z_1 = \frac{V_1}{i_1} = \frac{2\sqrt{3}}{\sqrt{3}} = 2 \quad Z_{in} = Z_s + Z_1 = \frac{3}{2} + 2 = \frac{7}{2}$$



$$T_1 = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix} \quad T_2 = \begin{bmatrix} 1 & 0 \\ s & 1 \end{bmatrix} \quad T_3 = \begin{bmatrix} 1 & s \\ 0 & 1 \end{bmatrix} \quad T_4 = \begin{bmatrix} 1 & 0 \\ s & 1 \end{bmatrix} \quad T_5 = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$T = T_1 T_2 T_3 T_4 T_5$$

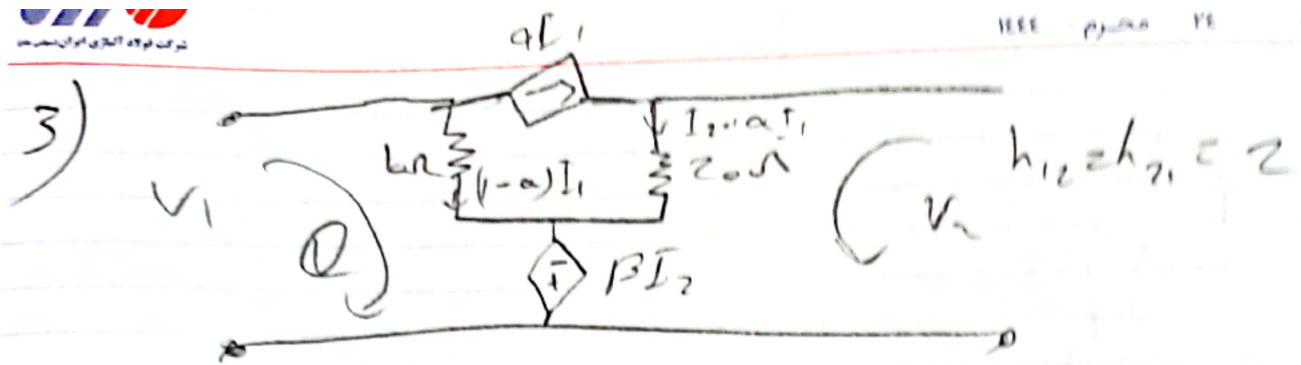
$$T_1 T_2 = \begin{bmatrix} 1+s & 1 \\ s & 1 \end{bmatrix} \quad T_3 T_4 = \begin{bmatrix} 1+s^2 & s \\ s & 1 \end{bmatrix}$$

$$T_1 T_2 T_3 T_4 = \begin{bmatrix} 1+s^3+s+s^3+s & s+s^2+1 \\ s+s^3+s & s^2+1 \end{bmatrix}$$

$$T_1 T_2 T_3 T_4 T_5 = \begin{bmatrix} s^3+s^2+2s+1 & s^2+s+1 \\ s^3+2s & s^2+1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} s^3+s^2+2s+1 + s^2+s+1 & s^2+s+1 \\ s^3+2s + s^2+1 & s^2+1 \end{bmatrix}$$

$$= \begin{bmatrix} s^3+2s^2+3s+2 & s^2+s+1 \\ s^3+s^2+2s+1 & s^2+1 \end{bmatrix} = T$$



$$\begin{bmatrix} V_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} h_{11} & h_{12} \\ h_{21} & h_{22} \end{bmatrix} \begin{bmatrix} I_1 \\ V_2 \end{bmatrix} \quad \begin{aligned} V_1 &= h_{11} I_1 + h_{12} V_2 \\ I_2 &= h_{21} I_1 + h_{22} V_2 \end{aligned}$$

KVL ① $\Rightarrow V_1 = 10 I_1 (1 - \alpha) - \beta I_2$ (I)

KVL ② $\Rightarrow V_2 = 20 (I_2 + \alpha I_1) - \beta I_2 = 20 \alpha I_1 + (20 - \beta) I_2$

$$I_2 = \frac{20 \alpha I_1}{20 - \beta} + \frac{+1}{20 - \beta} V_2$$

\Downarrow h_{21} \Downarrow h_{22}

$$V_1 = 10 (1 - \alpha) I_1 - \left(\frac{20 \alpha I_1}{20 - \beta} + \frac{1}{20 - \beta} V_2 \right) \beta$$

$$V_1 = \left(10 (1 - \alpha) + \frac{20 \alpha \beta}{20 - \beta} \right) I_1 - \frac{\beta}{20 - \beta} V_2$$

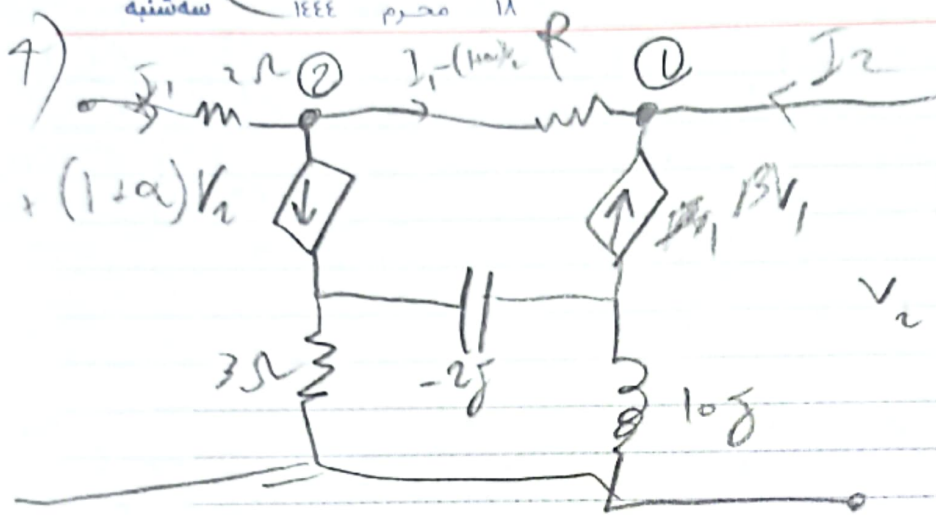
\Downarrow h_{11}

\Downarrow h_{12}

$h_{12} = 2 = \frac{-\beta}{20 - \beta} \Rightarrow 40 - 2\beta = -\beta \Rightarrow \boxed{\beta = 40}$

~~$h_{21} = \frac{20 \alpha}{20 - \beta} = \frac{20 \alpha}{20 - 40} = \frac{20 \alpha}{-20} = -\alpha$~~

$h_{21} = 2 = \frac{20 \alpha}{20 - \beta} = \frac{20 \alpha}{20 - 40} = \frac{20 \alpha}{-20} \Rightarrow \boxed{\alpha = -2}$



$$Z_{11} = \left. \frac{V_1}{I_1} \right|_{I_2=0} \begin{cases} \text{KCL } ① \Rightarrow I_1 = (1+\alpha)V_2 - \beta V_1 \\ \text{KVL } ③ \Rightarrow V_2 + R(-\beta V_1) + 2I_1 = V_1 \end{cases}$$

$$V_2 = V_1 - 2I_1 + R\beta V_1 \Rightarrow I_1 = (1+\alpha)(V_1 - 2I_1 + R\beta V_1) - \beta V_1$$

$$I_1(1 + 2(1+\alpha)) = V_1((1+\alpha)(1 + R\beta) - \beta)$$

$$Z_{11} = \frac{3 + 2\alpha}{(1+\alpha)(1 + R\beta) - \beta}$$

$$Z_{22} = \left. \frac{V_2}{I_2} \right|_{I_1=0} \begin{cases} \text{KCL } ②: I_2 + \beta V_1 = (1+\alpha)V_2 \\ \text{KVL } ③: \frac{1}{2}V_2 = (1+\alpha)V_2 R + V_1 \end{cases}$$

$$I_2 = V_2(-\beta(1 - R(1+\alpha)) + \frac{1}{1+\alpha})$$

$$Z_{22} = \frac{1}{-\beta(1 - R(1+\alpha)) + (1+\alpha)}$$

$$Z_{11} = Z_{22}$$

$$3 + 2\alpha = 1 - \beta \Rightarrow \alpha \geq 1$$

$$\alpha = 1$$

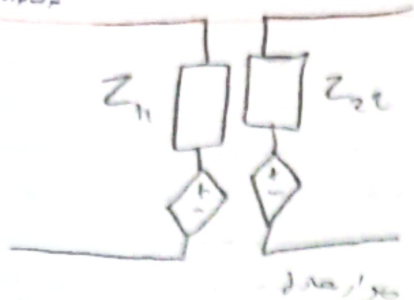
$$\beta \neq 0$$

$$10 \times 10^{-3} \text{ A}$$

$$\begin{aligned} 1 + \alpha - \beta + (1+\alpha)(R\beta) &= (1+\alpha)(1 + R\beta) - \beta \\ \Rightarrow 2 - \beta + R\beta &= 2(R\beta) - \beta + 2 \\ + \beta &= \beta \Rightarrow \beta \neq 0 \end{aligned}$$

$$\beta \in \mathbb{R}$$

5)



$$Z_{in} = \frac{s+1}{2s}$$

مقاومت ورودی

$$Z_{in} = \frac{1}{2s(s+1)} \text{ (است)}$$

ل اتصال کوتاه $V_2 = 0$

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

$$-I_2 = \frac{I_1 Z_{21}}{Z_{22}}$$

$$\frac{1}{2s(s+1)} = Z_{11} - \frac{Z_{12}^2}{Z_{22}}$$

$$V_1 = I_1 Z_{11} + I_2 Z_{12} \Rightarrow I_1 Z_{11} + \frac{-I_1 Z_{21}}{Z_{22}} Z_{12} = \frac{V_1}{I_1}$$

$$Z_{11} - \frac{Z_{12}^2}{Z_{22}}$$

$$I_2 = 0$$

$$V_1 = I_1 Z_{11} \Rightarrow \frac{s+1}{2s} = Z_{11}$$

$$\frac{1}{2s(s+1)} = \frac{s+1}{2s} - \frac{Z_{12}^2}{(s+1)}$$

$$\frac{1 - (s+1)^2}{2s(s+1)} = \frac{-s^2 - 2s}{2s(s+1)} = \frac{-s(s+2)}{2s(s+1)} = \frac{-2s}{(s+1)} Z_{12}^2$$

$$\frac{s(s+2)}{4s} = Z_{12}^2 \Rightarrow Z_{12} = \frac{1}{2} \sqrt{\frac{s+2}{s}}$$

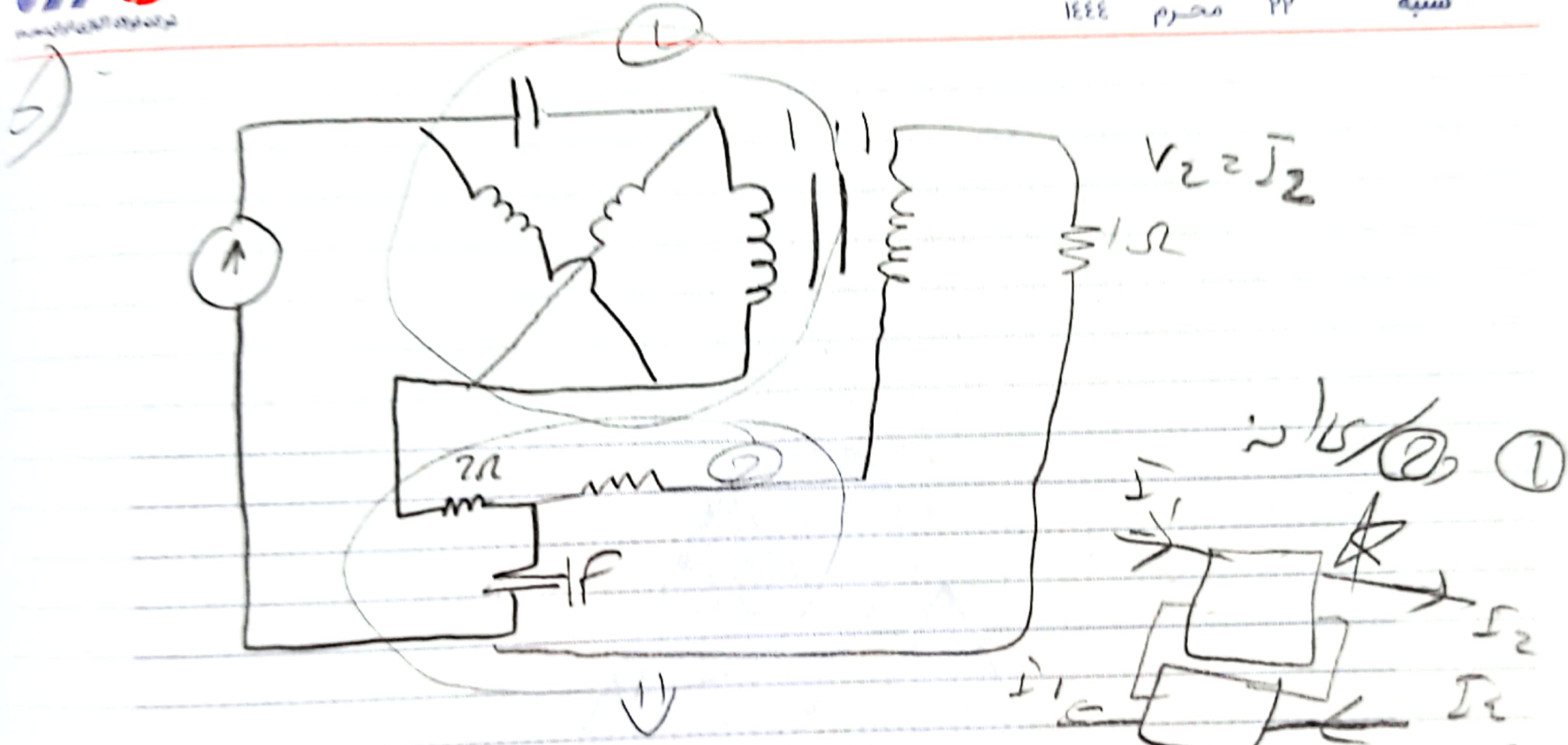
$$Z_L = \frac{s+1}{2s} - \frac{\frac{s+2}{4s}}{\frac{s+1}{2s} + Z_L} \Rightarrow Z_L + \frac{s+1}{2s} Z_L = \frac{(s+1)^2}{4s^2} - \frac{s+2}{4s}$$

آغاز بازگشت آزادگان به میهن اسلامی (۱۳۶۹ ه. ش)

$$Z_L^2 = \frac{(s+1)^2}{4s^2} - \frac{s+2}{4s} = \frac{s^2 + 1 + 2s - s^2 - 2s - 2}{4s^2} = \frac{-1}{4s^2} \Rightarrow Z_L = \frac{1}{2s}$$

ملاحظات

$$\text{بارن 2 دو فارار} \Rightarrow \frac{1}{1} 2f$$



$$\textcircled{1} \quad Z_{11} = \frac{V_1}{I_1} \Big|_{I_2=0} = (s - \frac{1}{2}) \parallel (s + \frac{1}{2}) = \frac{s^2 + 1}{s} \parallel \frac{s^2 + 1}{s} = \frac{s^2 + 1}{2s}$$

$$Z_{22} = Z_{11} = \frac{s^2 + 1}{2s}$$

$$Z_{12} = \frac{V_1}{I_2} \Big|_{I_1=0} = \frac{V_2 - \frac{I_2}{2s} - V_2 + \frac{I_2}{2}}{I_2} = \frac{1}{2s} + \frac{1}{2} = Z_{21}$$

$$Z_1 = \begin{bmatrix} \frac{s^2+1}{2s} & \frac{s^2-1}{2s} \\ \frac{s^2-1}{2s} & \frac{s^2+1}{2s} \end{bmatrix}$$

② $Z_{11} = \frac{V_1}{I_1} = 2 + \frac{1}{s} = Z_{22}$

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

$Z_2 = \begin{bmatrix} \frac{1}{s} + 2 & \frac{1}{s} \\ \frac{1}{s} & 2 + \frac{1}{s} \end{bmatrix}$

$Z_{eq} = Z_1 + Z_2 = \begin{bmatrix} \frac{s^2+1}{2s} + \frac{1}{s} + 2 & \frac{1}{s} + \frac{s^2-1}{2s} \\ \frac{1}{s} + \frac{s^2-1}{2s} & \frac{s^2+1}{2s} + 2 + \frac{1}{s} \end{bmatrix}$

$V_2 = \left(\frac{s^2+1}{2s} \right) I_1 = \left(\frac{s^2+1}{2s} + 2 + \frac{1}{s} \right) I_2 \Rightarrow V_2 = I_2$

$I_2 \left(2 + \frac{1}{s} + \frac{s^2+1}{2s} \right) = \left(\frac{s^2+1}{2s} \right) I_1$

$\frac{6s + 2 + s^2 + 1}{2s} =$

$\frac{I_2}{I_1} = \frac{s^2+1}{s^2+6s+3}$