Solution

1. $Z(s) = 2s+3/s+1 = 2(s+1)+1/s+1 = 2 + \frac{1}{s+1}$

writing $s = \sigma + j\omega$

then $Z(s) = 2 + \frac{1}{\sigma+1+j\omega}$

$$= 2 + \frac{(\sigma+1)-j\omega}{[(\sigma+1)+j\omega][(\sigma+1)-j\omega)]}$$

$$= 2 + \frac{(\sigma+1)-j\omega}{(\sigma+1)^2+\omega^2}$$

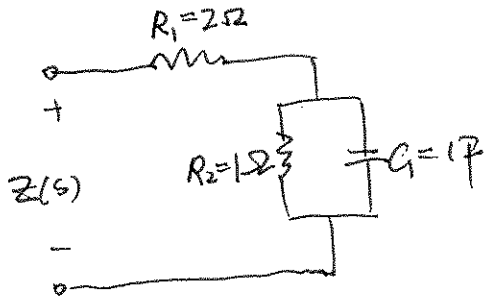
According to Positive Real (PR) property

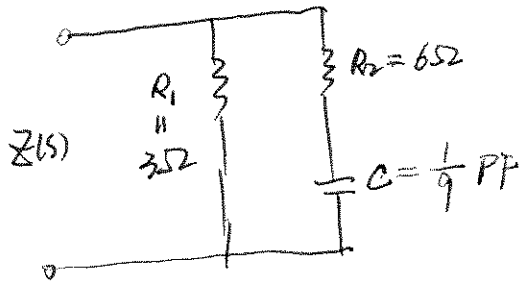
Let $Re\{s\} = \sigma \geq 0$

then $Re\{Z(s)\} = 2 + \frac{\sigma+1}{(\sigma+1)^2+\omega^2} > 0$

Therefore, we say $Z(s)$ is a PR function of s

An Example of such circuits (But not limited to) is:





Note: You should be clear about the units of the passive/active device you applied in the circuits. However, this time particular for the homework, the units are not criticria of your GRADE.

Question 2 ECE 587

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

$$h_{11} \equiv \left.\frac{V_1}{I_1}\right|_{V_2=0} \qquad h_{12} \equiv \left.\frac{V_1}{V_2}\right|_{I_1=0}$$

$$h_{21} \equiv \left.\frac{I_2}{I_1}\right|_{V_2=0} \qquad h_{22} \equiv \left.\frac{I_2}{V_2}\right|_{I_1=0}$$