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1. Which of the following function is lossless and why? Find the Cauer I and Foster-I expansion for the corresponding lossless function. (2+3+3)

$$Z(s) = \frac{s^2 + 10s + 24}{s^2 + 8s + 15}$$

$$Z(s) = \frac{s^5 + 10s^3 + 24s}{s^4 + 6s^2 + 5}$$

2. What are the properties of LC driving point impedance function? Which of the following function is valid LC driving point impedance function? State with reason.

$$Z(s) = \frac{8s^3 + 10s}{s^4 + 6s^2 + 5}, \quad Z(s) = \frac{(s^2+4)(s^2+9)}{(s^2+16)(s^2+25)}$$

Find the Cauer second form of valid driving point impedance function. (3+3+3)

3. Which of the following is valid lossless function? State with reason. Pick one of the valid LC lossless functions and synthesize it using Foster II and Cauer II methods. (3+3+3)

(i) $Z(s) = \frac{(s^2+4)(s^2+5)}{(s^2+2)(s^2+10)}$

(ii) $Z(s) = \frac{s^4+4s^2+3}{s(s^2+2)}$

(iii) $Z(s) = \frac{s^6+4s^4+8s^2}{s^3+3s}$

4. What are the properties of RC impedance function? Synthesize the given RC impedance in Foster & Cauer form.

$$Z(s) = \frac{3(s+2)(s+4)}{s(s+3)}$$