Total No. of Questions : 12]

SEAT No. :

P4364

[Total No. of Pages : 4

[5460]-15
T.E. (E & TC)
NETWORK SYNTHESIS AND FILTER DESIGN
(2008 Pattern)

Time :3 Hours] *[Max. Marks : 100*

Instructions to the candidates:

1) *Answers to the two sections should be written in separate books.*
2) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10, Q.11 or Q.12.*
3) *Use of electronic pocket calculator is allowed.*
4) *Figures to the right side indicate full marks.*
5) *Assume Suitable data if necessary.*

SECTION - I

Q1) a) List the properties of positive real function. **[6]**

b) Determine whether the polynomials F(s) are Hurwitz **[8]**

i) $F(s)=s^4+s^3+5s^2+3s+4$

ii) $F(s)=s^4+s^3+2s^2+3s+2$

c) For a two port network, define all the transfer functions. **[4]**

OR

Q2) a) Explain the significance of poles and zeros in network synthesis. Also discuss effect of poles and zeros on response. **[6]**

b) Determine whether the following function is positive real function **[4]**

$$Z(S)=\frac{s^2+1}{s^3+4s}$$

c) For the network shown in Fig. 1, find current transfer ratio $\alpha_{12}(s)$ and transfer impedance $Z_{21}(s)$. **[8]**

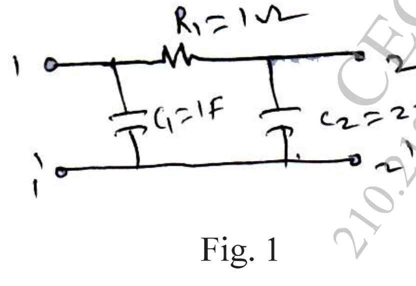

Fig. 1

P.T.O.

Q3) a) Synthesize the following one port network function in both foster forms **[8]**

$$Z(S) = \frac{2(s^2+1)(s^2+9)}{s(s^2+4)}$$

b) Synthesize the following one port network function in both Cauer forms **[8]**

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

OR

Q4) a) List properties of one port RC driving point impedance function. **[6]**

b) Indicate with reasons which of the following driving point functions are RC, LC or RL. Out of that realize only RL function in first foster and first Cauer forms. **[10]**

i) $Z(S) = \frac{s^3+2.6s}{s^4+4s^2+3}$

ii) $Y(S) = \frac{s^2+2.5s}{s^2+5s+6}$

iii) $Y(S) = \frac{2(s+1)(s+3)}{(s+2)(s+6)}$

Q5) a) Define constant resistance network. For a constant resistance Lattice or Bridge T network prove that $Z_aZ_b=R^2$ **[8]**

b) Synthesize $Z_{21}(S) = \frac{s^3}{s^3+3s^2+4s+2}$

as a LC ladder with 1 Ω termination. **[8]**

OR

Q6) a) Synthesize the all pass function. **[6]**

$\frac{V_o}{V_{in}} = \frac{s^2-2s+2}{s^2+2s+2}$ as a lattice network terminated into 1Ω.

b) Synthesize voltage ratio

$\frac{V_2}{V_1} = \frac{s+2}{s+3}$

as a constant resistance bridge T network terminated by 1Ω. **[6]**

c) Identify the zeroes of transmission for the network in Fig.2. **[4]**

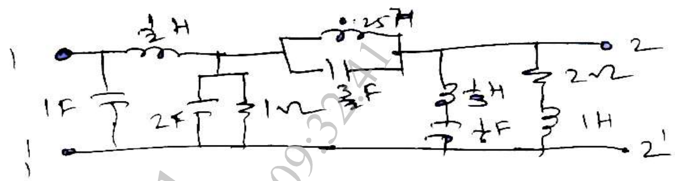

Fig. 2

SECTION - II

Q7) a) Explain the need and concept of magnitude and frequency normalization in context with filter designing. **[6]**

b) Realize a third order Butterworth low pass filter transfer impedance terminated in load of 500 Ω with a cut off frequency of 10^4 rad/sec. Also convert it into high pass of same specifications. **[12]**

OR

Q8) a) Compare Butterworth and Chebyshev approximation. **[6]**

b) Design a Chebyshev approximated low pass filter with not more than 1 dB ripple in pass band and 20 dB attenuation at 2 rad/sec. **[12]**

Q9) a) What are different biquad feedback topologies used in active filter design. **[8]**

b) Synthesize a 2^{nd} order high pass filter having cut off frequency 1kHz using the Sallen and Key circuit based on positive feedback. **[8]**

OR

Q10) a) What is cascade approach in active filter synthesis? Explain in detail and list its advantages. **[8]**

b) Design a second order Butterworth low pass active filter having upper cut off frequency 1kHz. **[8]**

Q11) a) Define sensitivity and its significance. Derive the property of sensitivity,

$$S_x^{y_1+y_2} = \frac{y_1 S_x^{y_1} + y_2 S_x^{y_2}}{y_1 + y_2}.$$ **[8]**

b) Find the transfer function (V_2/I_1) of a passive network shown in Fig.3. Also compute the sensitivities of K, ω_p and Q_p with respect to elements. **[8]**

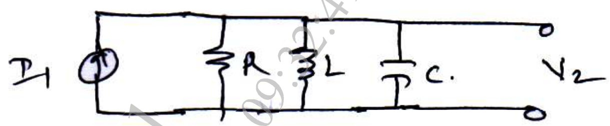

Fig. 3

OR

Q12) a) Describe the properties of op-amp such as dynamic range, slew rate, offset voltage, input bias and input offset currents and common mode signal in contest of filter design. **[8]**

b) Derive the sensitivity properties : **[8]**

i) $S_x^{y^n} = nS_x^y$

ii) $S_{x^n}^y = \frac{1}{n} S_x^y$

iii) $S_x^y = S_p^y S_x^p$

iv) $S_x^{pq} = S_x^p + S_x^q$