M.E. (ETC) 1st Semester Final Examination, 2012

Active Network Analysis and Synthesis (ETC-919)

Time: 3 hours Full Marks: 70

Answer Question No.7 and any THREE from the rest

1. (a) Describe different properties of network function. Write down the general form of a network function. Check to see whether the following network function is stable or not? $H(s) = (s^2 - s + 1)/(s^2 + s + 1)$. Sketch the s-domain pole-zero diagram of $s(s^2+1)/(s^2+2)$.
(b) How LC driving point impedance function can be written in partial fraction expansion form?
(c) What are the properties of general transfer functions? Sketch the approximate magnitude and phase plot of a transfer function: $H(s) = s^2 + as + b$. Derive the expression of pole frequency and pole-Q in term of a and b.

(8+4+8)

2. (a) Write down the n^{th} order Chebyshev function in term of normalized frequency. Hence drive the Chebyshev lowpass approximate filter function. Derive the expression for estimating the order of the filter for normalized LP Chebyshev approximation.
(b) Draw the plot of 4^{th} order Chebyshev function and Chebyshev lowpass approximate filter function with respect to normalized frequency.
(c) The passband loss of a 4^{th} order Butterworth LP approximation function has 1 dB at 500 Hz. Beyond what frequency is the loss greater than 40 dB?

(10+4+6)

3. (a) What do you understand by biquadic function? Draw the positive feedback biquad topology. Analyzing the feedback and feedforward transfer functions, find out the overall transfer function. Explain the special properties for such topology.

(b) How we can attenuate the gain constant associate with active circuit by using inverting amplifier? Also describe the gain enhancement technique of such circuit.

(12+8)

4. (a) Realize both lowpass and bandpass function using three amplifier biquard.
(b) Hence synthesis a general biquadratic function using summing four amplifiers.
(c) Synthesis the following function using summing four amplifier biquard:
$T(s) = (s^2 - 40s + 160000)/(s^2 + 40s + 160000)$.
Specify the type of transfer function is it?

(10+4+6)

5. (a) Synthesis the lowpass function: $T(s) = 2b/ (s^2 + as + b)$ using the positive feedback circuit as given in Figure-1, where a, b are positive constants. Find out the overall transfer function. Obtain the expressions for filter parameters using coefficient-matching technique.

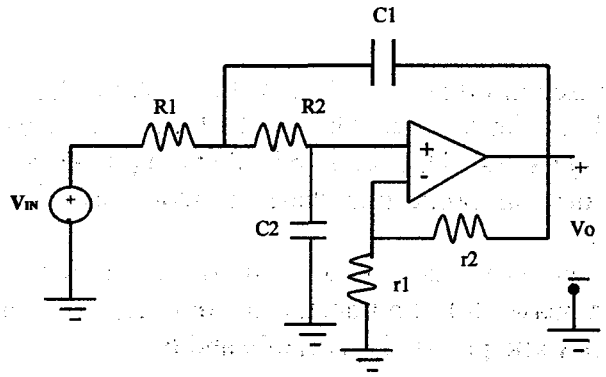


Figure-1

(b) How is more general lowpass function ('d' instead of '2b' in above transfer function) be synthesized?

(14+6)

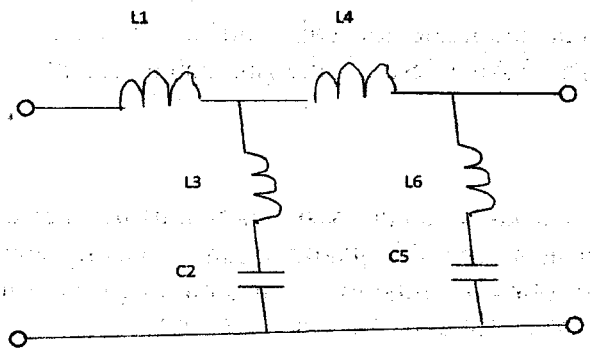
6. (a) What do you understand by low sensitive network? Write down the different steps for synthesis the network function of a singly terminated ladder network

(b) Explain Zero shifting technique in this context. Synthesis a LC ladder network, which has the Z parameters:

$$Z_{11} = (s^2+1)(s^2+3)/(s(s^2+2)) \quad Z_{12} = (s^2+4)(s^2+5)/(s(s^2+2))$$

Using the tropology below, sketch the pole-zero pattern at each step and indicate the zero shifting and zero producing elements.

(10+10)



7. Write short note on any one of the followings: (10)

(a) Gyrator (b) FDNR