M.E. (ETC) 1st Semester Final Examination, 2013

Active Network Analysis and Synthesis (ETC-919)

Time: 3 hours | Full Marks: 70

Answer Any FIVE questions. Questions are equal valued.

1.(a) Write down the common properties of all Network Functions. Check to see whether the following network function is stable or not? $H(s) = (s-1)/(s^2+4)$.

(b) Write down the special properties of LC driving point impedance function. How such functions 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: $H(s) = 1/(s^2+as+b)$. Derive the expression of pole frequency and pole-Q in term of a and b.

(3+5+6)

2. (a) Write down the characteristics of Butterworth approximation function. Derive the expression of loss function in term of normalized frequency.

(b) Find the loss at stopband edge frequency 45 rad/sec for a 3th order Butterworth filter that has a maximum loss 0.5 dB at the pass band edge frequency of 9 rad/sec Draw the delay characteristics of the function.

(c) For Butterworth approximation function, prove that its 2n numbers of roots are located on the unit circle and are equally spaced at π/n radian intervals. Hence find out the approximate function for the 3rd order normalized Butterworth lowpass filter.

(5+4+5)

3. (a) Write down the n^{th} order Bessel polynomial and find out the factored form of the normalized Bessel approximation for n upto 4.

(b) The delay of LP Bessel approximation function is required to be flat to within 5% of the dc delay of 1 msec upto passband edge frequency of 1800 rad/sec and the loss must exceed 40 dB at 14000 rad/sec. Determine Bessel approximation function and the loss and delay at 1800 rad/sec and14000 rad/sec.

(c) Describe the design steps of a Delay Equalizer.

(5+4+5)

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

(b) Determine the transfer function Vo/V_{IN} of the network, by writing the node equations for node1 and node2 assuming an OP Amp with a finite gain A.

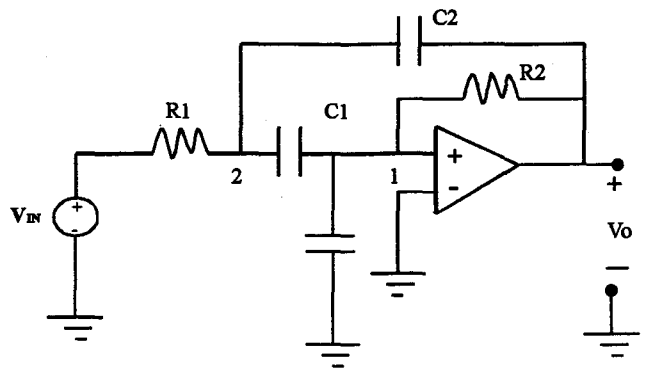

Figure-1

(c) Exercise the same for an ideal OP Amp.

(6+6+2)

5. (a) How can you enhance the gain of an active circuit? Describe with suitable diagram.
(b) Show how the gain constant associated with the circuit as shown in Figure-2 can be increased by a factor of 5 using element-splitting gain enhancement technique.

(8+6)

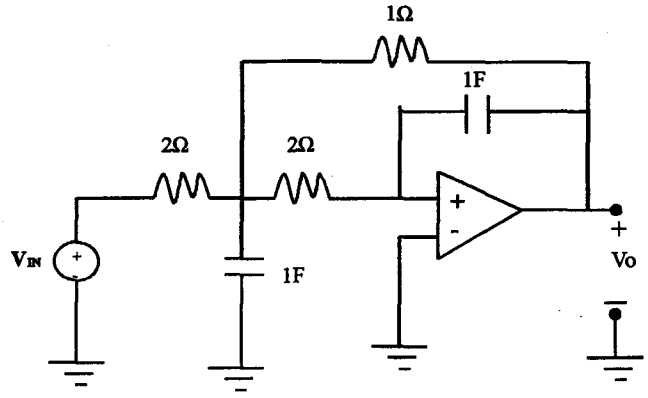

Figure-2

6. (a)What do you understand by sensitivity of a network? How the sensitivities of the parameters of biquadratic filter function are defined?

(b)Find out the transfer function of the active circuit given in Figure-4. Obtain the expressions for filter parameters using coefficient-matching technique.

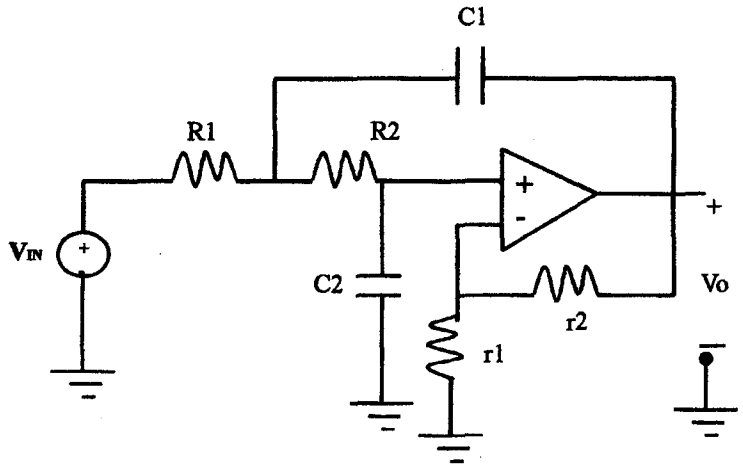

Figure-4

(c) Find out the sensitivity terms of the different parameters of the filter function.

(4+7+3)

7. (a) What do you understand by low sensitivity of passive network?
(b) Write down the different steps for synthesis the network function of a singly terminated ladder network
(c) Explain Zero shifting technique in this context.

(4+7+3)

8, Write short notes (any two)
(a) Realization of lowpass function using three amplifier biquard.
(b) GYRATOR
(c) Switched capacitor network
(d) FDNR

(7 x 2)