COLLEGE OF ENGINEERING, PUNE

(An Autonomous Institute of Government of Maharashtra.)
SHIVAJI NAGAR, PUNE - 411 005

END Semester Examination

(ET-207) Network Synthesis and Analog Filters

Course: B.Tech Branch: Electronics and TeleCommunication Engineering

Semester: Sem III

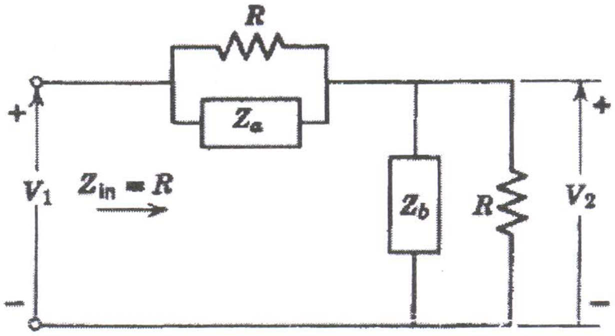
Year: 2014-2015 Max.Marks:60

Duration: 3 Hours Time:- 10 to 1.00 p.m **Date: /12/2014** Dec 2014

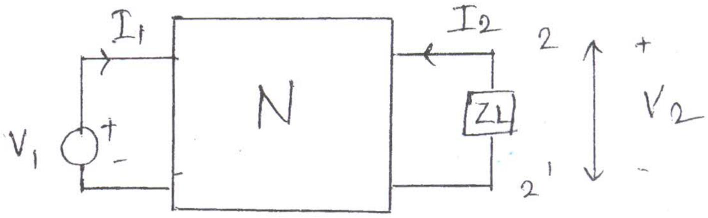
Instructions: **MIS No.** | | | | | | | | | |

1. Figures to the right indicate the full marks.
2. Mobile phones and programmable calculators are strictly prohibited.
3. Writing anything on question paper is not allowed.
4. Exchange/Sharing of anything like stationery, calculator is not allowed.
5. Assume suitable data if necessary.
6. Write your MIS Number on Question Paper

Q 1 (a) For the network in the figure, show that the driving point impedance Z_{in} is equal to R when $Z_a . Z_b = R^2$ 4



(b) (i) The network N is terminated at port 2-2′ with an impedance $Z_L = \frac{1}{Y_L}$. Show that $\frac{V_2}{V_1} = \frac{-y_{21}}{y_{22}+Y_L}$. 4



(ii) What do you mean by reciprocal and symmetrical networks. Explain by appropriate examples.

OR

Show the response of Chebyshev Low pass Filter for N=1,N=2, N=3. Which filter approximation according to you should be preferred and why?

(c) Explain with the help of a diagram, ANY FOUR of the following parameters of a practical Low pass Filter. 4

(i) Cut off Frequency
(ii) Stop Band Frequency
(iii) Pass band Ripple(δ_p)
(iv) Stop Band Ripple(δ_s)
(v) Gain roll-off

OR

Justify the necessity of using a higher order filter (with appropriate diagrams of N=2,3... for Butterworth LPF). Obtain the transfer function of a 3rd order normalized Butterworth filter and plot the poles on the S-plane.

Q 2 (a) (i) Let a Network Function 3

$$Z(s) = \frac{a_n s^n + a_{n-1} s^{n-1} + a_{n-2} s^{n-2} + \ldots + a_1 s + a_0}{b_m s^m + b_{m-1} s^{m-1} + b_{m-2} s^{m-2} + \ldots + b_1 s + b_0} = \frac{P(s)}{Q(s)}$$

Explain the basic operation of Removal of a pole at s $=\infty$ from the function.

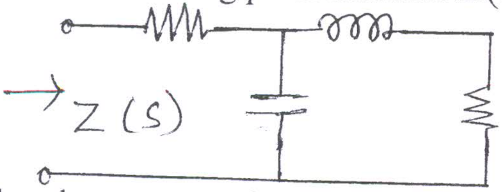
(ii) What do you mean by critical frequencies? State their significance.

OR

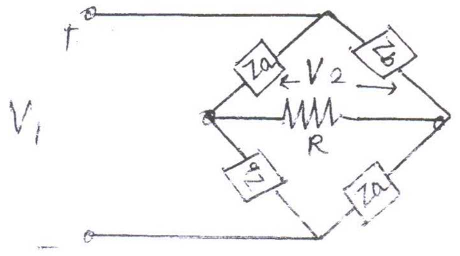
(ii) Find whether the following is RC impedance function. If yes, synthesize it in Foster 1 form.

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

(b) Realize the driving point function $Z(s) = \frac{s^2+2s+2}{s^2+s+1}$ into the form shown below: 3



(c) What do you mean by a Constant resistance Network. Give a condition for a bridge network to be a Constant Resistance Network. 4
Derive the Open Circuit (z) parameters for the Bridge / Lattice network shown below.



(d) Find the Transfer Function and Order N of an Equi-ripple filter having following specifications: 5

(i) Maximum Passband Ripple (δ_p) = 1 dB

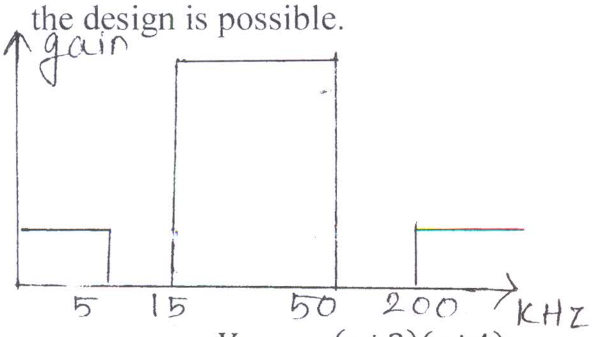
(ii) Ω_p= 1.2 rad/s

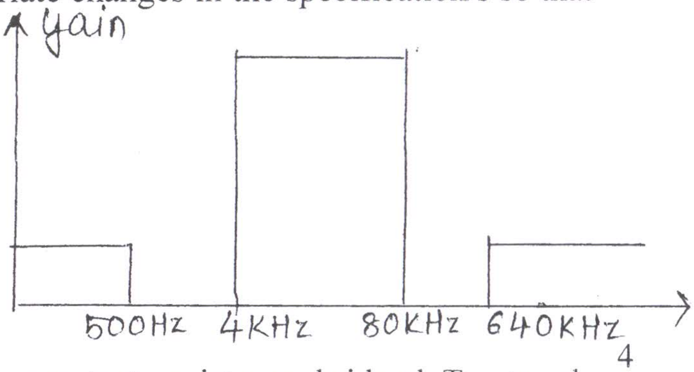
(iii) Stop band Attenuation (δ_s) is 40dB for Ω_s= 4 rad/s.

Q 3 (a) Synthesize the following into L-C ladder network with 1Ω termination 4

$$Z_{21} = \frac{2}{s^3+s^2+4s+2}$$

(b) State the advantages of Active Filters over Passive Filters. The Frequency Response of two Bandpass Filters is shown below.Is it possible to design the filters with the given specifications?If not, suggest appropriate changes in the specification/s so that the design is possible. 5

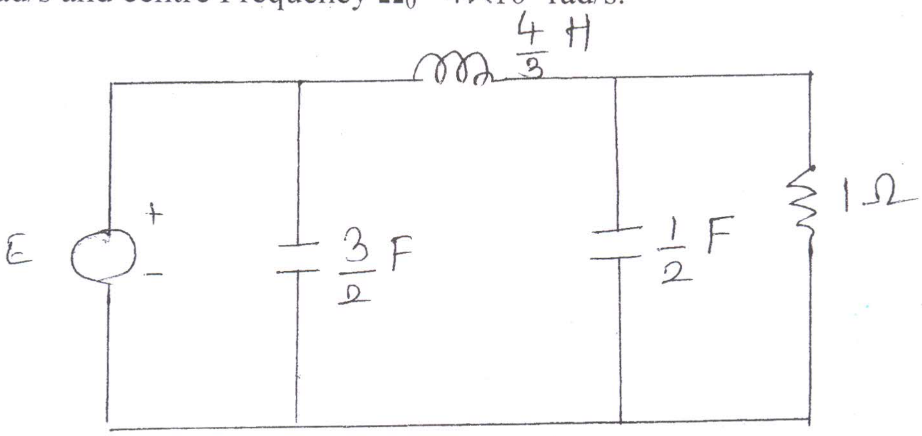




(c) Synthesize $\frac{V_2}{V_1} = \frac{(s+2)(s+4)}{(s+3)(3s+4)}$ as a constant resistance bridged T-network connected in Cascade. 4

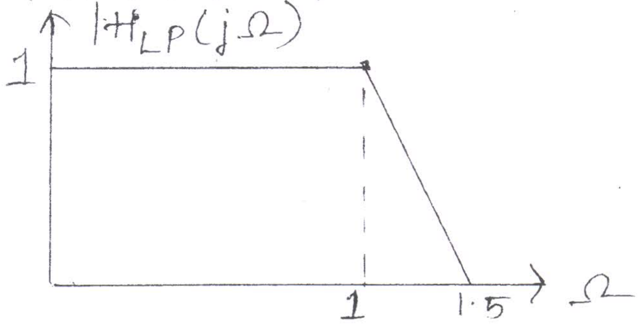
(d) (i) Illustrate with appropriate frequency response diagrams, the transformation of a passive low pass filter into band-pass filter. Derive the expressions for the cut off frequencies Ω_1 and Ω_2 of the transformed band-pass filter. 6

(ii)Convert the LPF below into Band Stop Filter with Bandwidth B = 6×10^4 rad/s and centre Frequency Ω_0= 4×10^4 rad/s.



Q 4 (a) A certain low pass filter has already been designed with its magnitude characteristic $|H_{LP}(j\Omega)|$ as shown below. 5

The transform $S = \frac{6s}{s^2+269}$ is applied to this function to obtain a band- reject characteristic. Give a sketch of the band-reject magnitude characteristic. Give all crucial specifications(Ω_1 , Ω_2 , Ω_0 and B) on this characteristic.



(b) (i) Design a 3rd order Active Low Pass Filter with cut off frequency of 1kHz. 5

(ii)State the significance of Quality Factor Q and Damping Factor in Filter design.

(c) Convert a 2nd order active LPF into a HPF to get a cut off frequency of 330 Hz. 4