

Total No. of Questions : 8]

SEAT No. :

P2864

[4958]-1053

[Total No. of Pages : 4

T.E.(Electronics)
NETWORK SYNTHESIS
(2012 Course) (Semester-I)

Time : 2½Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of electronic pocket calculator is allowed.*
- 4) *Assume suitable data, if necessary.*

Q1) a) State the properties of positive real function and check the following

function for positive real function. $Z(s) = \frac{(s + 2)}{s^2 + 3s + 2}$. [6]

b) Synthesize the following function into Foster- I and Cauer-I form.

$$Z(s) = \frac{s(s^2 + 9)}{(s^2 + 1)(s^2 + 16)}. \quad [6]$$

c) Define zeros of transmission and synthesize the following transfer function into a ladder network with 1 ohm termination.

$$Z_{21}(s) = \frac{s^3}{s^3 + 3s^2 + 4s + 2} \quad [8]$$

OR

Q2) a) When is the network said to be causal and stable. State and explain conditions for stability and causality of a network function. [6]

b) State the properties of RC driving point admittance function and realize the following function into Cauer- I form

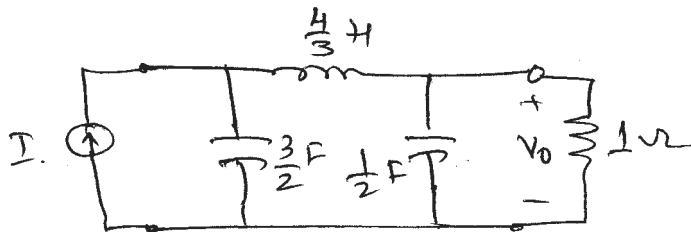
$$Y(s) = \frac{8s^2 + 10s}{s + 1} \quad [6]$$

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- c) State the properties of transfer function and realize the following voltage transfer function.

$$\frac{V_2}{V_1} = \frac{(s-1)(s^2 - 2s + 2)}{(s+1)(s^2 + 2s + 2)} \quad [8]$$

- Q3)** a) State the properties of Butterworth approximated filter. [4]
 b) Realize the transfer function of a third order low pass Butterworth filter as a transfer impedance function. [6]
 c) Consider the low pass filter of Figure① and convert it into a band pass filter with 1Ω termination and bandwidth 6×10^4 rad/sec with band pass center frequency 4×10^4 rad/sec. [6]



Figure①

OR

- Q4)** a) Explain the need and concept of impedance and frequency scaling as used in filter designing. [6]
 b) State the properties of Chebyshev approximation technique. [4]
 c) Obtain a system function $H(s)$ that exhibits the Chebyshev characteristics with not more than 1 dB ripple in passband and attenuation of 20 dB at $\omega = 2$ rad/sec. [6]
- Q5)** a) Compare active and passive filters. [4]
 b) Synthesize the second order low pass filter to have a pole frequency of 10 kHz and a pole Q of 5 using saraga design of salten-key circuit. [6]

- c) What is cascade approach in active filter synthesis. List the advantages of the cascade approach. [6]

OR

- Q6) a) Explain the different biquad feedback topologies used in active filter designing and important considerations. [6]

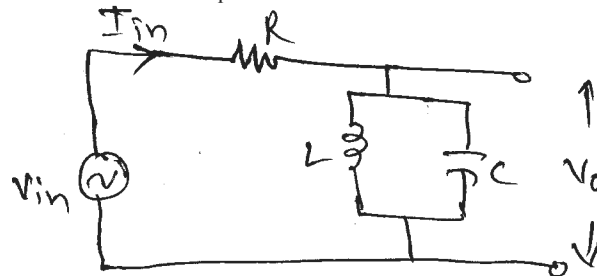
- b) Design a first order active RC low pass Butterworth filter with cut off frequency 20kHz and pass band gain of 3.6. (use positive feedback topology) [4]

- c) Synthesize the following high pass filter function using RC - CR transformation.

$$T_{HP}(s) = k \cdot \frac{s^2}{s^2 + s + 16} \quad [6]$$

- Q7) a) What is sensitivity. Write the properties of sensitivity function. [4]

- b) For R-L-C circuit shown in Figure② find the transfer function $\frac{V_o}{I_{in}}$ and compute the sensitivities of gain constant K, resonant frequency (ω_p) and quality factor (Q_p) with respect to R, L and C. [6]



Figure②

- c) Explain the effect of following op-amp parameters on active filter response. [8]

- i) Input offset voltage
- ii) Slew rate
- iii) Input offset current
- iv) Dynamic range

OR

Q8) a) Prove the following sensitivity relationships.

[6]

i)
$$S_x^{p_1+p_2} = \frac{p_1 S_x^{p_1} + p_2 S_x^{p_2}}{p_1 + p_2}$$

ii)
$$S_x^{p^n} = n S_x^p$$

iii)
$$S_{x^2}^p = \frac{1}{2} S_x^p$$

b) Explain the concept of gain sensitivity. Also explain the various factors affecting gain sensitivity. [6]

c) The input to the inverting amplifier shown in Figure 3 is a sine wave of amplitude 5 volts. If slew rate of op-amp is 1 V/ μ sec, find the frequency at which slew rate limiting occurs. [6]

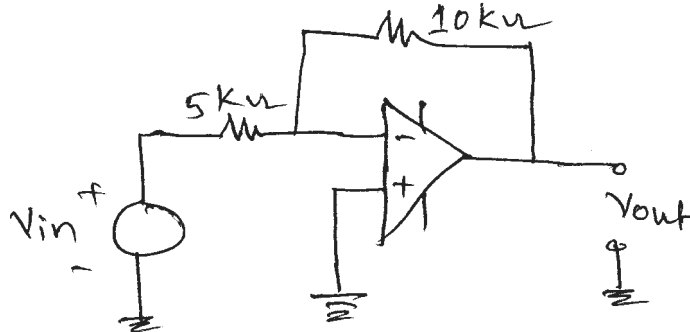


Figure 3

