Total No. of Questions : 8]

SEAT No. :

P 3272

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[5353] - 145

TE (Electronics)

NETWORK SYNTHESIS

(2012 Pattern)

Time : 2:30 Hours] *[Max. Marks :70*

Instructions to the candidates:

Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.

***Q1*)** a) Synthesize function using Foster forms. **[6]**

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

b) Realize network function, with 1 Ω termination. **[6]**

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

c) Prove that $\frac{V_2}{V_g}=\frac{1}{2}\frac{R-Z_a}{R+Z_a}$ of constant resistance lattice, whose source and load impedance are equal to R. **[8]**

OR

Q2) a) Explain elementary synthesis concepts **[6]**

i) Removal of pole at infinity

ii) Removal of pole at origin

iii) Removal of conjugate imaginary poles

b) Determine range of K in P (s) so that given polynomials are hurwitz. **[6]**

i) $P(s) = s^3 + 20s^2 + 5s + 10K$

ii) $P(s) = s^4 + 25s^3 + 15s^2 + 20s + K$

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c) Test whether following functions are positive real function or not. **[8]**

i) $F(s) = \dfrac{3s^2 + 5}{s^3 + s}$

ii) $P(s) = \dfrac{2s^2 + 2s + 1}{s^3 + 2s^2 + s + 2}$

Q3) a) Explain frequency and impedance scaling with suitable example. **[6]**

b) State properties of Butterworth approximation. **[4]**

c) Determine transfer function of Chebyshev low pass filter to meet the following specification. **[6]**

i) $1dB$ ripple in the pass band

ii) Cut off frequency $\omega_c = 10 \times 10^5$ *rad/sec*

iii) The magnitude must be down to $25d$ B at $\omega = 3 \times 10^6$ *rad/sec*

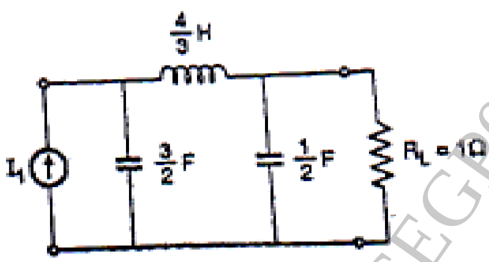
OR

Q4) a) Comparer Butterworth and Chebyshev Approximation Techniques. **[4]**

b) Determine transfer function and realize low pass Butterworth approximation filter whose requirements are cheracterized by, **[6]**

$A_{max} = 1dB$, $A_{min} = 30dB$, $\omega_s = 350 rad/sec$

c) Normalized third order low pass filter is shown below in figure **[6]**



Design c [illegible] s cut off frequency $\omega_c = 10^6$ *rad / sec* and the impedance load of 500Ω

Q5) a) Design 2nd order Sallen and key high pass Butterworth filter having cutoff frequency of $300H_z$ **[4]**

b) Explain the different biquad feedback topologies used in active filter designing and list the important observations **[6]**

c) Synthesize the following high pass filter function using RC-CR transformation. **[6]**

$$H(s) = \frac{Ks^3}{S^2 + s + 36}$$

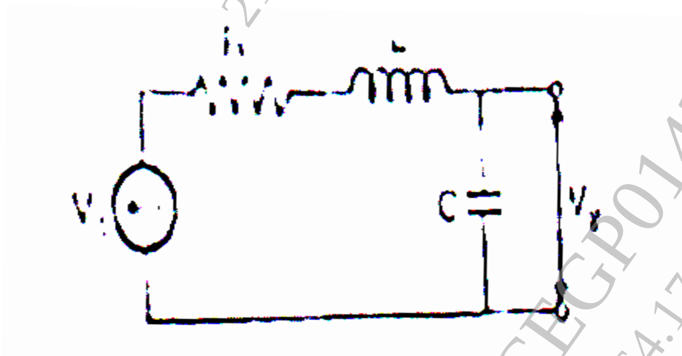
OR

Q6) a) Differentiate between passive and active filters. **[4]**

b) Synthesize 2nd order active low pass Butterworth filter to have a cut off frequency of 159.15KHz then using RC-CR transformation, realize with same cut off frequency. **[6]**

c) What are the advantages and disadvantages of Active filter? **[6]**

Q7) a) For the series RLC circuit shown in figure, Calculate the sensitivities of K, the resonant frequency ω_p, the quality factor Q_p with respect to R,L and C. Comment on the obtained result. **[6]**



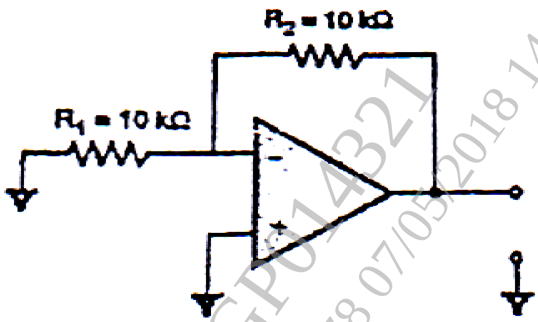
b) Prove the following sensitivity relationships **[6]**

i) $S_x^{P^n} = nS_x^p$

ii) $S_{\sqrt{x}}^P = 2S_x^P$

iii) $S_x^{y+c} = \frac{y}{y+c} S_x^y$

c) The op-amp used in the inverting circuit in figure, has an input bias curren of 600nA and an input offset current that canrange between ±100nA. Find the resulting maximum output offset voltage. **[6]**



OR

Q8) a) Define sensitivity, Give some of its important properties. **[4]**

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

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

i) Input offset voltage

ii) Input bias current

iii) Slew rate

iv) CMRR

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