This question paper contains 6 printed pages.

3347 *Your Roll No.....*

B.Tech. (EC) / III

(Part Time) **J**

NETWORK ANALYSIS AND FILTER DESIGN

(EEC - 305)

Time : 3 hours *Maximum Marks :70*

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt any five questions.
All questions carry equal marks.
Assume missing data suitably.

1. a) Show that the biquadratic function

$$F(s) = \frac{s^2 + a_1 s + a_0}{s^2 + b_1 s + b_0}$$

is positive real if

$$a_1 b_1 \geq (\sqrt{a_0} - \sqrt{b_0})^2$$ *05*

b) Synthesize the following function in both the foster forms

$$Z(s) = \frac{z(s^2 + 1)(s^2 + 9)}{s(s^2 + 4)}$$ *06*

c) Test whether following polynomial is Hurwitz.

$P(s) = s^7 + 2s^6 + 2s^5 + s^4 + 4s^3 + 8s^2 + 8s + 4$ *03*

2 a) An impedance function has the pole zero pattern shown in Fig. 1. If Z (-2) = 3. Synthesize the impedance in a one Foster form and one Caver form. *08*

P.T.O

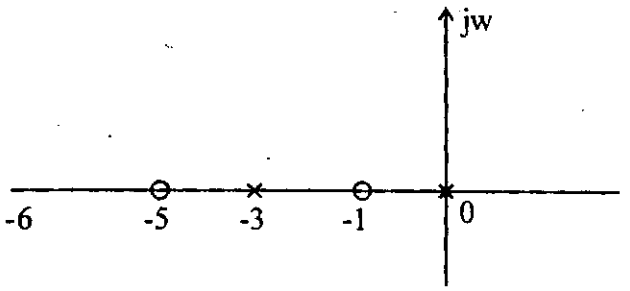

Fig. 1

b) Describe the properties of RL impedance function. Synthesize the impedance function

$$Z(s) = \frac{2(s+1)(s+3)}{(s+2)(s+6)}$$ in one Foster form. *06*

3 a) Consider a double terminated lattice as shown in Fig 2. Show that under constant resistance condition, the voltage ratio.

$$\frac{V_2}{V_1} = \frac{1}{2}\frac{(R - Z_a)}{(R + Z_a)}$$ *05*

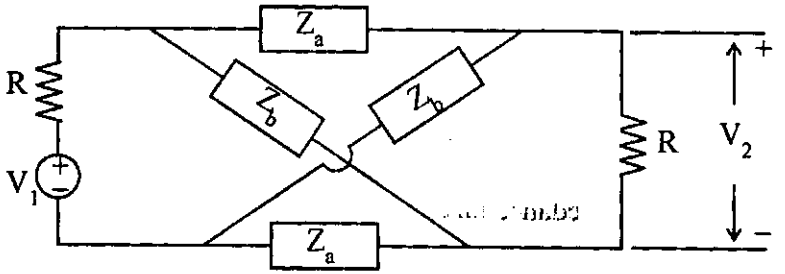

Fig. 2

b) Synthesize the voltage ratio

$$\frac{V_2}{V_1} = \frac{(s+2)(s+4)}{(s+3)(3s+4)}$$

in terms of two constant - resistance bridged T circuits connected in tandem. *05*

c) Obtain expression for the voltage ratio V_2/V_1 for the circuit shown in Fig 3. Where does this circuit find its applications? *04*

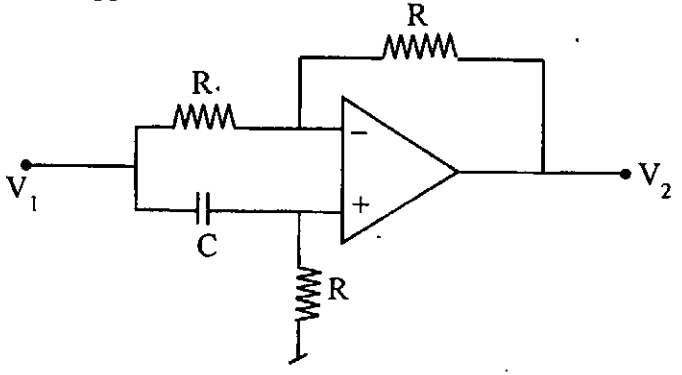

Fig. 3

4 a) Draw a normal tree of the network shown in Fig. 4. Write the normal form state equations. *04*

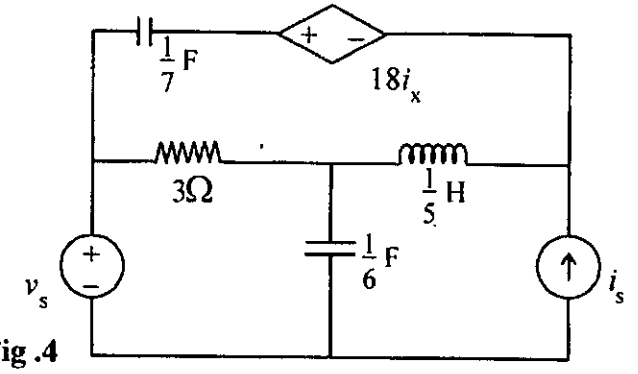

Fig .4

P.T.O.

b) The specification for a Butterworth band pass filter are:

$\alpha_p \leq 3.0$dB for 50k rad $< w <$ 72k rad

$\alpha_s \geq 40$dB for $w <$ 30k rad; $w >$ 120k rad

Find its transfer function. *10*

5 a) Design a second order Butterworth low pass filter with a corner frequency at 100rad/s and a voltage gain magnitude of z at zero frequency. *06*

b) In the circuit of Fig 5, determine the transfer fucntions

$$H_1(s) = \frac{V_0}{V_i} \text{ and } H_2(s) = \frac{V_1}{V_i}$$

and classify each as low pass or bandpass filter. *08*

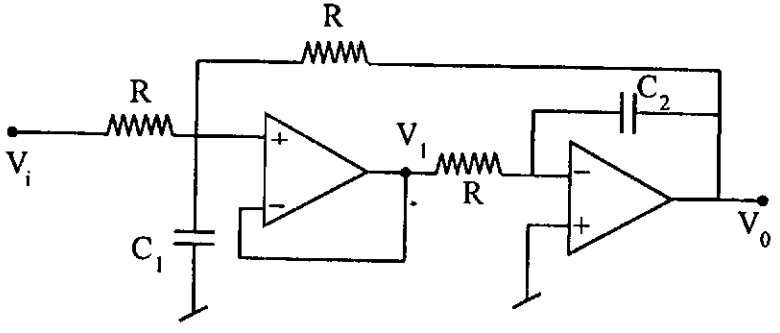

Fig. 5

6 a) Obtain expression for transfer function of a second order sallen - key band pass filter. *05*

b) Show that circuits given in fig 6(a) and fig 6(b) are equivalent. *09*

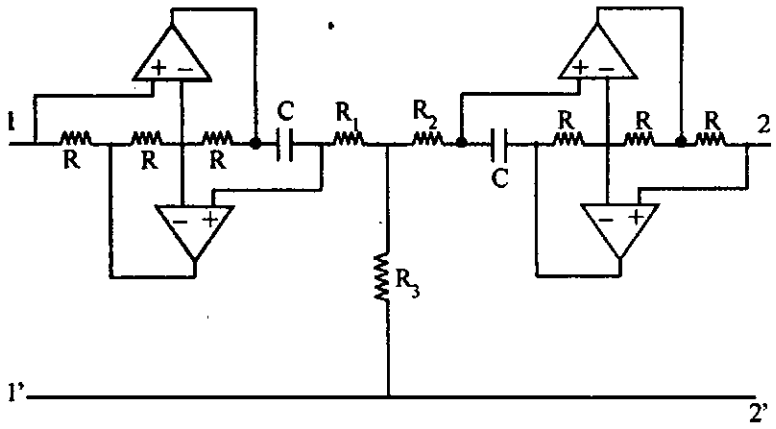

Fig. 6(a)

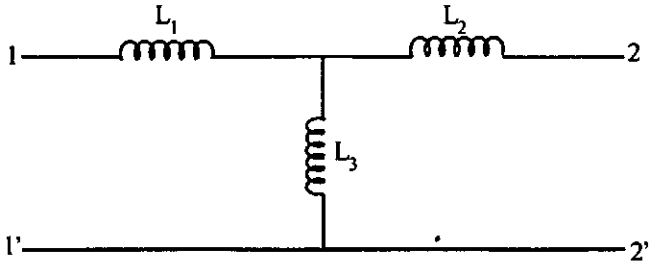

Fig. 6(b)

7 a) Show that the Tow - Thomas Biquad circuit shown in fig. 7 realizes low pass and band pass responses simultaneously. *09*

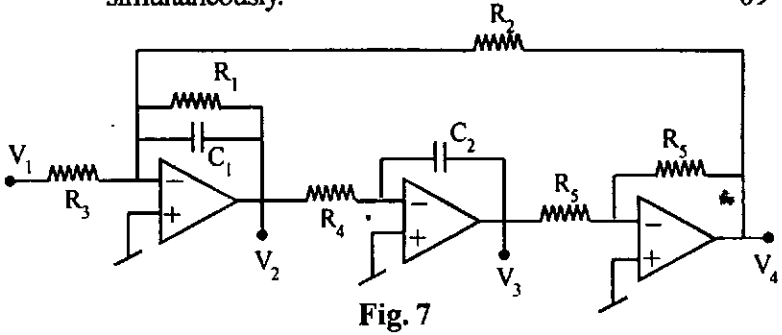

Fig. 7

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b) Find the input impedance for the circuit shown in fig 8. *05*

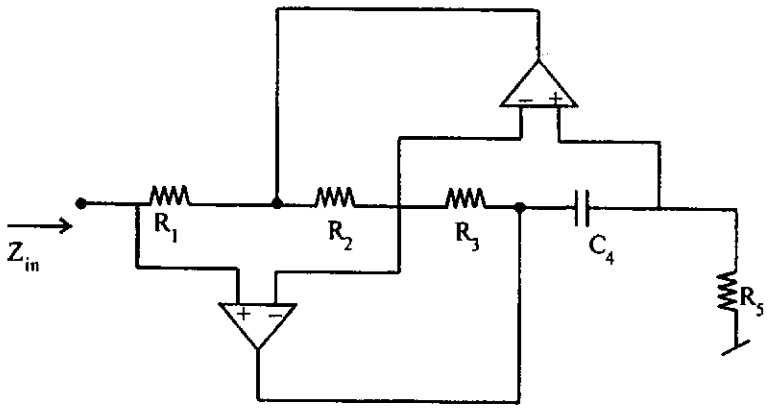

Fig. 8