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B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2004.

Third Semester

Electronics and Communication Engineering

EC 231 — NETWORK ANALYSIS AND SYNTHESIS

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Write the laplace transform of unite step function $u(t)$ and $e^{-atu(t)}$.

2. Write any two basic properties of laplace transforms.

3. What is meant by isomorphic graph?

4. Write the formula to compute number of links corresponding to any tree of a graph.

5. Define causality and stability of synthesis.

6. Write any two properties of L–C immittance function.

7. Write the relation between series and shunt impedances of prototype filters.

8. Define cut off frequency.

9. Write any two limitations of active filter.

10. Write any two active filter specifications.

PART B — (5 × 16 = 80 marks)

11. (i) Find the Laplace transform of the square wave shown in Fig. 1. (8)

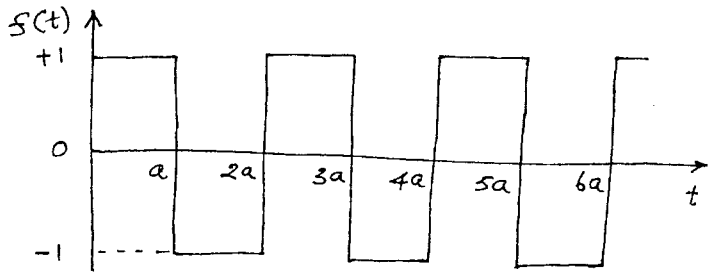

Fig. 1

(ii) For the RC network shown in Fig. 2, find the driving point input impedance Z_{11}. Plot the pole-zero plot of this network function. (8)

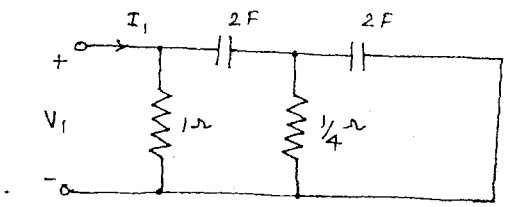

Fig. 2

12. (a) For the electrical network of Fig. 3, draw its topological graph and write its incidence matrix. Choose a tree and write the fundamental loop matrix corresponding to the chosen tree. (16)

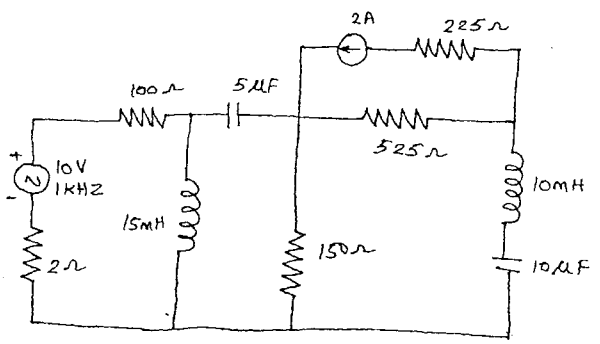

Fig. 3

Or

Write the state equation in the normal form for the network shown in Fig. 4 using equivalent source method. (16)

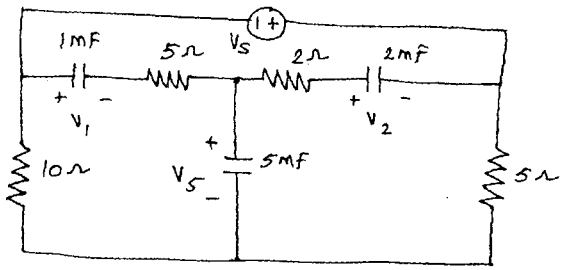

Fig. 4

(a) (i) Briefly explain the properties of Hurwitz polynomial. (8)

(ii) Check whether the function $F(s) = \dfrac{s^2 + 4}{s^3 + 3s^2 + 3s + 1}$ is positive real? (8)

Or

(b) (i) Realize the network for which the driving point impedance function is given by (8)

$$z(s) = \frac{s + 2}{s(2s + 5)}.$$

(ii) Synthesize the following transfer function of the LC network in second Foster form (8)

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

(a) Find the component values of π – section-k high pass filter having cut off frequency of 8 KHz and nominal characteristic impedance of 600 Ω. Hence find its characteristic impedance and phase constant at f = 12 KHz and attenuation at f = 0.8 KHz. (16)

Or

(b) Design a m-derived low pass filter (π -section) having cut-off frequency 1 KHz, design impedance of 400 Ω, and the resonant frequency 1100 Hz. (16)

(a) With a help of neat block diagram derive the design equations of second order active high-pass filter. (16)

Or

(b) (i) Explain briefly about the cascading of active filters. (8)

(ii) Design a second order Butterworth band-pass filter with a mid band gain of A_0 = 34 dB, centre frequency f_0 = 160 Hz and 3 dB bandwidth = 16 Hz. (8)