D 029

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2003.

Third Semester

Electronics and Communication Engineering

EC 231 — NETWORK ANALYSIS AND SYNTHESIS

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Ideal Voltage Source.

2. For a capacitor with initial voltage $v_c(0-)$, write down the expressions for current and voltage in *S*-domain.

3. A series network consists of a resistor $R = 1\,\Omega$ and a capacitor $C = 0.05\,\mu$F. Write down the expression for magnitude and phase response with respect to frequency.

4. A series RC circuit is excited by a voltage source $v(t)$ at time $t = 0$. Write down the state space equation.

5. Define 'positive real function'.

6. List four important properties of a driving point impedance function of an RC network.

7. Compare Butterworth and Chebyshev approximations.

8. With an example, illustrate voltage controlled voltage source.

9. Find the *Z*-parameters of a *T*-network having 1 H series arm impedances and 0.5 F shunt arm capacitance.

10. Draw the circuit diagram of a second order single OP-AMP Sallen-Key low pass filter.

PART B — (5 × 16 = 80 marks)

11. Derive the state space equations of a second order RLC series circuit excited by a voltage source $v(t)$. If the parameter matrix A has the elements $A_{11} = -2$, $A_{12} = 1$, $A_{21} = 0$, $A_{22} = -1$, find the state transition matrix.

12. (a) For the network shown in Figure 12.a, find the current $i_2(t)$. The network is deenergised before $t = 0$.

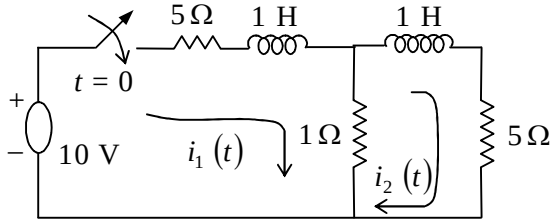

Figure 12.a

Or

(b) For the resistive network shown in Figure 12.b, draw a graph, select a tree and obtain tie-set matrix. Write down the KVL equations from the tie-set matrix.

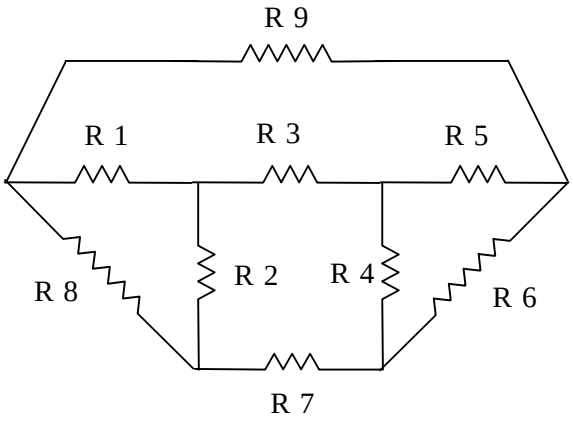

Figure 12.b

13. (a) Realise the function $F(S) = (S^2 + 1)/S(S^2 + 2)$ in Foster form I.

Or

(b) For the function $Z(S) = (S^2 + 1)(S^2 + 9) / S(S^2 + 4)$. Obtain Cauer form II.

14. (a) Obtain the transfer function of a Butterworth lowpass filter for the following specifications :

(i) Cutoff frequency $w_c = 0.75$ rad/sec.

(ii) Amplitude is 20 dB down at $w = 3$ rad/sec.

Or

(b) Design a normalised second order Butterworth high pass filter by frequency transformation and plot the approximate magnitude response.

15. (a) (i) What are the advantages of active filters over passive filters?

(ii) Describe the principle of operation of an active second order high pass filter.

Or

(b) Describe the principles of design of an active low pass filter.

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