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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech S4 (Hons.) Degree Examination May 2025 (2023 Admn)

Course Code: EET292

Course Name: NETWORK ANALYSIS AND SYNTHESIS

Max. Marks: 100 Duration: 3 Hours

PART A

(Answer all questions; each question carries 3 marks) Marks

1 Describe Tree, Co-Tree and Twig of a graph with proper examples 3

2 From the reduced incidence matrix given, draw the oriented graph of the network 3

$$A = \begin{bmatrix} 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ -1 & -1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & -1 & -1 & -1 & 0 & 0 \end{bmatrix}$$

3 What is meant by dual of a network graph to have a dual? Illustrate with an example. 3

4 What is meant by Tellegen's theorem 3

5 Find the image impedances of the following two port network 3

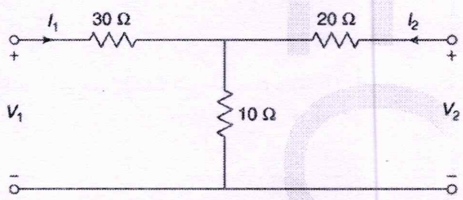

Figure 1

6 Classify the filters based on frequency characteristics 3

7 List the necessary and sufficient conditions for a function to be Positive Real 3

8 3

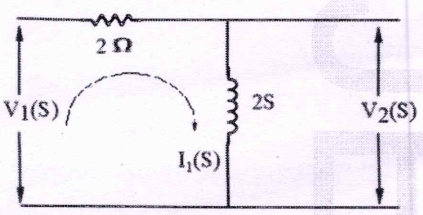

Figure 2

For the network shown in Figure 2, obtain the transfer functions $G_{21}(S)$ and $Z_{21}(S)$

9 Discuss the properties of LC immitance functions. 3

10 Determine whether following functions are RC impedance function or not. Justify your answer 3

(a) $Z(s) = \frac{3(s+2)(s+4)}{s(s+3)}$

(b) $Z(s) = \frac{2(s+1)(s+3)}{(s+2)(s+6)}$

PART B

(Answer one full question from each module, each question carries 14 marks)

Module -1

11 a) Find all voltages and branch currents in the network shown in Figure 3 by node analysis, and applying network graph principles 10

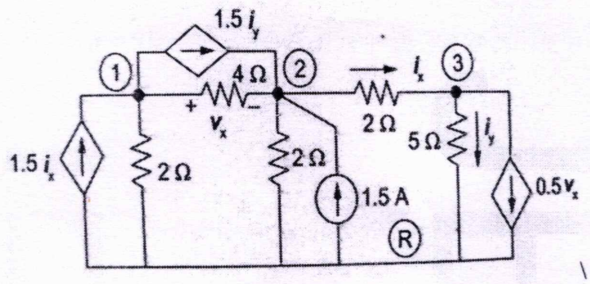

Figure 3

b) For the circuit shown in Figure 4 draw the oriented graph and write the tie-set matrix 4

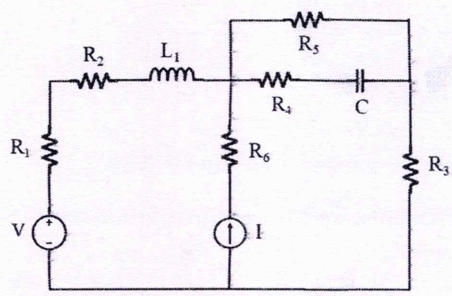

Figure 4

12 a)

Determine the power delivered by each current source in the circuit given in Figure 5 by nodal analysis

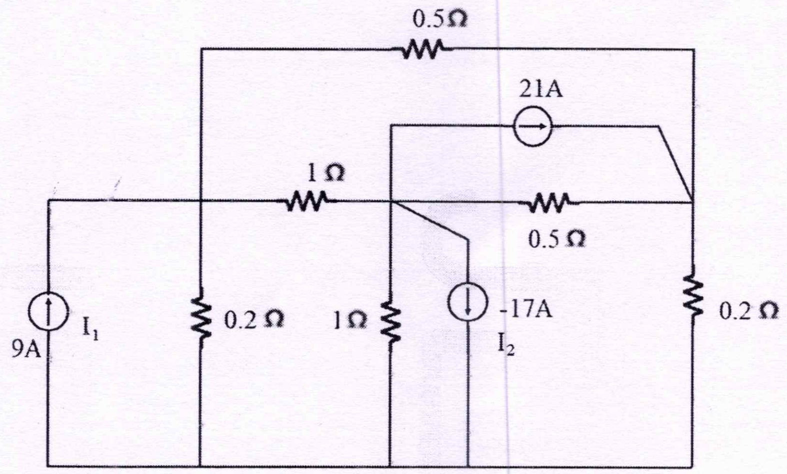

Figure 5 9

b) For the network shown in Figure 6, obtain the incidence matrix and nodal admittance matrix 5

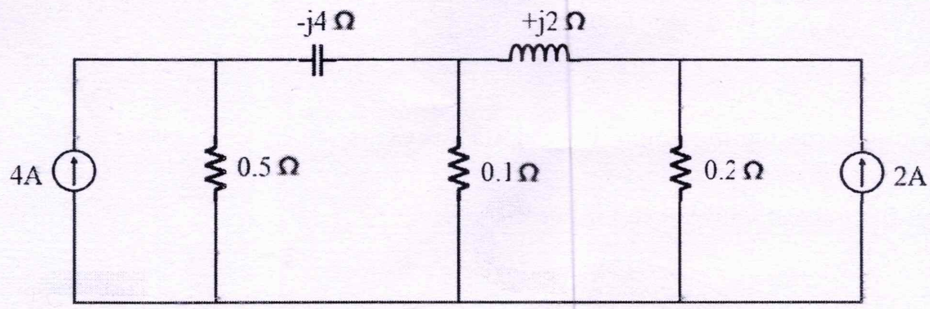

Figure 6

Module -2

13 a) Find the dual of the following circuits shown in Figure 7 and Figure 8 Show all intermediate steps 4

(i)

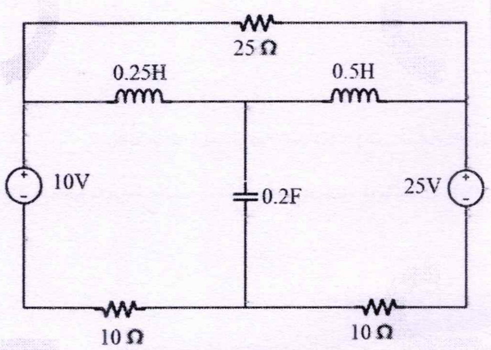

Figure 7

(ii) 4

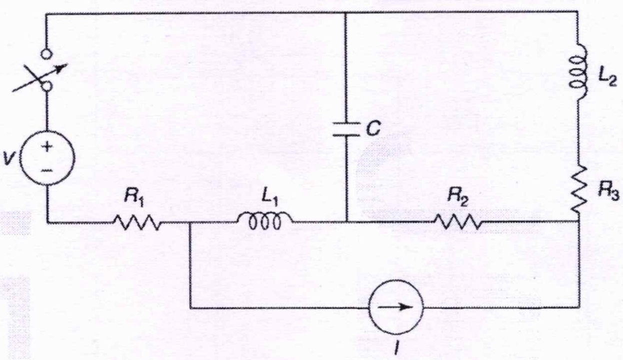

Figure 8

b) Determine the B_f matrix for a graph with reduced incidence matrix 6

Branches:	1	2	3	4	5	6	7
A= node-1	-1	1	0	0	0	0	1
node-2	0	-1	0	1	1	0	0
node-3	0	0	-1	0	-1	1	-1

Without drawing the graph. Use {2,3,5} as twigs

14 a) For the network shown in Figure 9

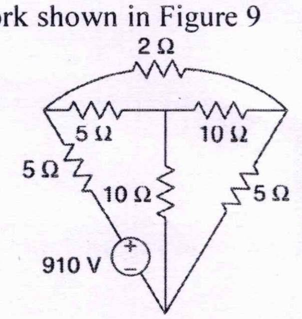

Figure 9

a) Draw the oriented graph . 2

b)Obtain the f-cutset matrix 2

c) Calculate the twig voltages using KCL equation for the network 6

b) Obtain the relationship between circuit matrix , tie set matrix and incidence matrix 4

Module -3

15 a) Design the T and π section of a constant K-type BPF with cut-off frequency of 4 kHz and 10 kHz and nominal characteristic impedance of 500 Ω. 7

b) Design an m-derived pi-section low-pass filter having cut-off frequency of 1500 Hz, design impedance of 500 Ω and infinite attenuation frequency of 2000 Hz. 7

16	a)	1.Design the T and Pi section of constant-k high pass filter having cut-off frequency of 10kHz and nominal characteristic impedance $R_0 = 600\ \Omega$.	5
		2. Find characteristic impedances and phase constant at 25kHz.	3
		3. Find attenuation at 5kHz and 30kHz	2
	b)	Design a T-type attenuator to give an attenuation of 60 dB and characteristic resistance of 500 Ω	4

Module -4

17	a)	Given $I_{(S)} = \frac{3s}{(s+1)\ (s+3)}$. Draw the pole-zero diagram of the network function, and hence, find time-domain response i(t).	5
	b)	State the conditions to be satisfied for a Hurwitz polynomial	3
	c)	Test whether the polynomial P(s) is Hurwitz or not (i) P(s)= $s^3 + 4s^2 + 5s + 2$ (ii) P(s)= $s^4 + s^3 + 3s^2 + 2s + 12$	6
18	a)	Test whether F(s) is positive real function or not (i) F(s)= $\frac{s^3+6s^2+7s+3}{s^2+2s+1}$ (ii) F(s)= $\frac{s^2+4}{s^3+3s^2+3s+1}$	8
	b)	Find the limits of K so that the polynomial $s^3 + 3s^2 + 2s + K$ may be Hurwitz.	6

Module -5

19	a)	Realise the Cauer I and II forms of the following impedance function Z(s)= $\frac{(s+2)(s+6)}{2(s+1)(s+3)}$	10
	b)	Obtain the Foster I form of the RL impedance function Z(s)= $\frac{s(s+4)(s+8))}{(s+1)(s+6)}$	4
20		Realise the impedance function Z(s) in three different ways Z(s)= $\frac{4(s^2+1)(s^2+9)}{s(s^2+4)}$	14

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