Register No.: ..... Name: .....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FOURTH SEMESTER B.TECH DEGREE EXAMINATION (R), MAY 2024

(2020 SCHEME)

Course Code : 20EET296

Course Name: Network Analysis and Synthesis

Max. Marks : 100 **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. Explain graph, subgraph and tree of a circuit with an example.
2. Describe how KCL is applied in fundamental circuit matrix formulation.
3. Describe the relation between circuit, cut set and incidence matrices with example.
4. Explain Tellegen's theorem.
5. Draw the frequency response curves for ideal and non-ideal low pass filter, band pass filter and high pass filter respectively.
6. Explain how transmission lines are modelled using 2-port networks .
7. Describe the necessary and sufficient condition for a positive real function.
8. Test whether the following polynomial is Hurwitz or not.

$$F(s)=s^4+7s^3+4s^2+18s+6$$

9. List the properties of RC Impedance function.
10. Draw the Foster and Cauer forms of R-L network.

PART B

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

MODULE I

11. a) Draw the graph corresponding to the given incidence matrix.

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

(5)

b) For the electrical network shown in Fig. 1 draw its topological graph and write its incidence matrix, tie-set matrix, link current transformation equation and branch currents. (9)

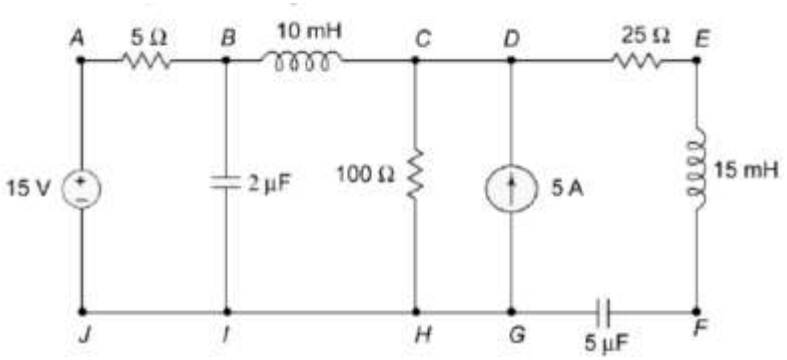

Fig. 1

OR

12. a) For the network shown in figure 2 draw the oriented graph, write the tie-set schedule and obtain the equilibrium equations. (9)

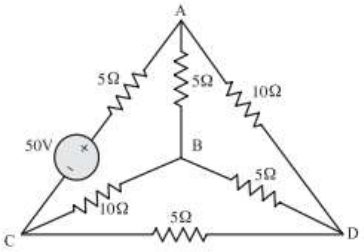

Fig. 2

b) Draw the oriented graph of the reduced incidence matrix shown below. (5)

$$A = \begin{bmatrix} -1 & -1 & 0 & 0 & 1 & 00 \\ 0 & 1 & 1 & 0 & 0 & 10 \\ 0 & 0 & -1 & 1 & 0 & 01 \end{bmatrix}$$

MODULE II

13. a) For the given oriented graph(Fig.3) obtain the cut-set matrix and branch voltages. Take 4 and 6 as the twigs. (5)

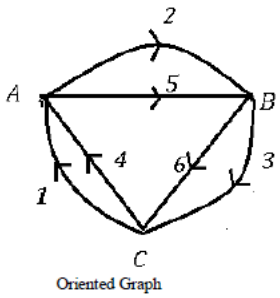

Fig.3

b) For the circuit shown in Fig. 4, determine all branch voltages, using cut set analysis. (9)

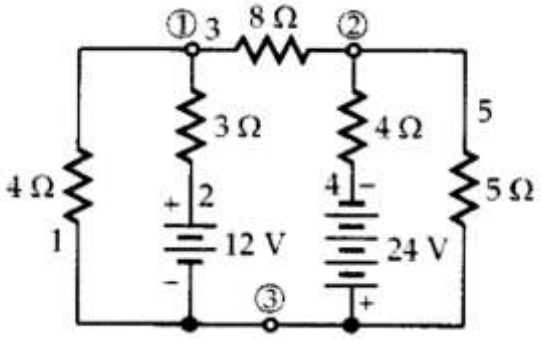

Fig. 4

OR

14. a) Illustrate the condition for duality of a network graph with example (5)

b) For the network shown in Fig. 5 obtain the tie-set matrix and loop currents (9)

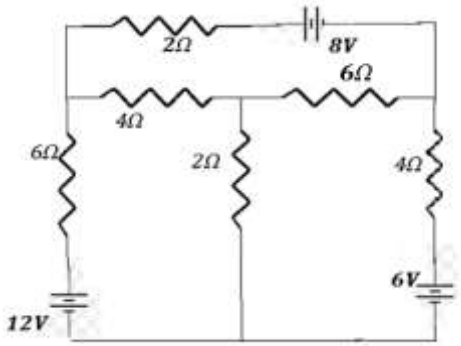

Fig. 5

MODULE III

15. a) Derive the characteristic impedance and propagation constant for T network under sinusoidal steady state (7)

b) Design a constant k low pass filter having cut off frequency 2 kHz and nominal characteristic impedance Ro=600 Ω. Also find the frequency at which this filter offers attenuation of 19.1 dB (7)

OR

16. a) Derive the image impedances of a two-port network in terms of ABCD parameters (6)

b) Design an m-derived T and Π section low pass filter having a characteristic impedance of 600 Ω, cut-off frequency of 1800 Hz and infinite attenuation at 2000 Hz. (8)

MODULE IV

17. a) Determine whether the following functions are positive real or not

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

(ii) $F(s)=\dfrac{3s+5}{s(s^2+1)}$ (10)

b) List the properties of Hurwitz polynomial. (4)

OR

18. a) For the pole-zero plot shown in Fig.6, for a network function, identify the function and find its impulse response. (6)

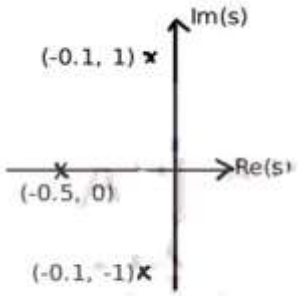

Fig. 6

b) Find the limits of K so that the polynomial $s^3+14s^2+56s+K$ may be Hurwitz. (8)

MODULE V

19. a) Realize the given impedance function in Foster I and II form.

$$Z(s)=\frac{5(s^2+4)(s^2+25)}{s(s^2+16)}$$ (9)

b) Realize the Cauer-1 form of the given network.

$$Y(s)=\frac{(s^2+1)(s^2+9)}{s(s^2+4)}$$ (5)

OR

20. a) Find the first and second Foster form of the function.

$$Z(s)=\frac{3(s+2)(s+4)}{(s+1)(s+3)}$$ (8)

b) Obtain the First Cauer form of the following function.

$$Z(s)=\frac{(s+8)(s+4)}{(s+2)(s+6)}$$ (6)

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