Register No.: ..... N0ame : .....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FOURTH SEMESTER B. TECH DEGREE EXAMINATION (Regular), JULY 2022

(2020 SCHEME)

Course Code : **20EET296**

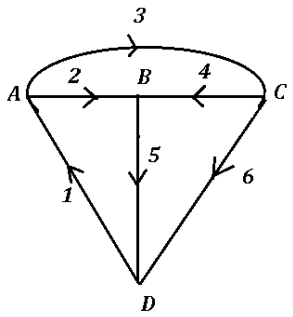
Course Name: **Network Analysis and Synthesis**

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

PART A

(Answer all questions. Each question carries 3 marks)

1. List the properties of complete incidence matrix.
2. Define graph, tree and sub graph of a circuit with an example.
3. Obtain the basic cut set matrix for the network graph shown below. Take 2,4,5 as tree branches.



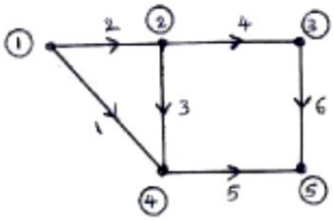
4. Explain Tellegen's theorem.
5. Describe the image impedance of a two-port network.
6. The currents of a two-port network are given by
   $I_1 = 6V_1 - V_2$
   $I_2 = -V_1 + 2V_2$
   Find the equivalent π network.
7. Explain the necessary and sufficient conditions for positive real functions.
8. List out the properties of Hurwitz polynomial.
9. Explain the properties of RC driving point impedance function.
10. Find the 2nd foster form of the RL driving point function:
    $$Y(s) = (2s^2 + 16s + 30) / (s^2 + 6s + 8)$$

PART B

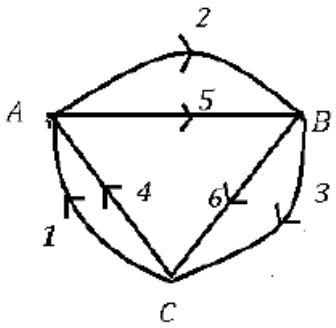
(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) Obtain the complete and reduced incidence matrix for the graph shown below. (5)



b) For the given oriented graph, obtain the cut-set matrix and branch voltages. Take 4 and 6 as the twigs. (9)

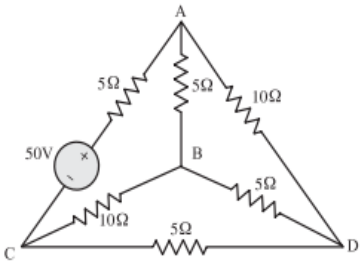


OR

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

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

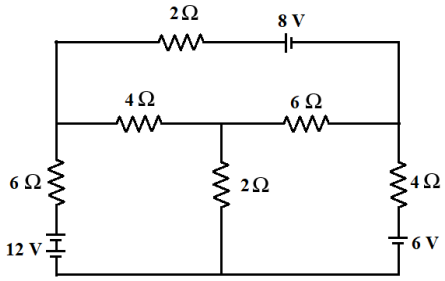
b) For the network shown in figure, draw the oriented graph. Write the tie-set schedule and obtain the equilibrium equations. (9)



MODULE II

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

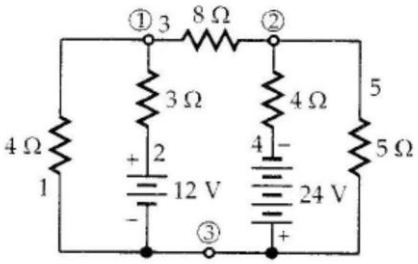
b) For the network shown in figure obtain the tie-set matrix and loop currents. (9)



OR

14. a) Describe the formulation of tie-set and cut set with examples. (5)

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



MODULE III

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

b) Design a constant k-type low pass filter having cut off frequency 2 kHz and nominal characteristic impedance R_o=600 Ω. Also find the frequency at which this filter offers attenuation of 19.1 dB. (8)

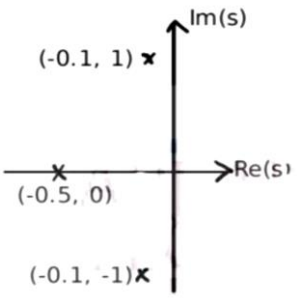
OR

16. a) Describe the gain characteristics of low pass, high pass, band-pass and band-reject filters. (4)

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. (10)

MODULE IV

17. a) For the pole-zero plot shown in figure below, for a network function, identify the function and find its impulse response. (5)



b) Test whether the following polynomials are Hurwitz or not (9)

(i) $s^5 + s^3 + s$

(ii) $s^3 + 2s^2 + 4s + 2$

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

OR

18. a) List the properties of positive real functions (4)

b) Determine whether the following functions are positive real or not (10)

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

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

MODULE V

19. a) Realize the given impedance function in Foster I and II form (9)

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

b) Draw the Foster and Cauer form of RC network (5)

OR

20. a) Draw the Foster and Cauer form-II of LC network. Also write the properties of LC immittance. (8)

b) Obtain the First Cauer form of the following function (6)

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

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