QP Code:EEH41-1 **(Pages:3)**

Reg No : ..... Name : .....

MAR ATHANASIUS COLLEGE OF ENGINEERING, KOTHAMANGALAM

(Govt. Aided Autonomous Institution)

Fourth Semester B.Tech. Degree Examination, May, 2026

Course Code: B24EEH41

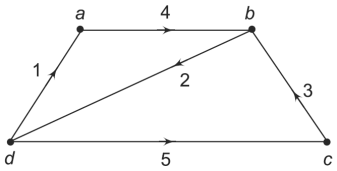
Course Name: NETWORK ANALYSIS AND SYNTHESIS

Max. Marks: 100 Duration:3 Hours

PART - A: 30 Marks (10 Qns x 3 Marks)

Answer all questions

1. What is meant by orientation of a graph in network analysis? Explain with an example.
2. Illustrate the process of obtaining KVL from the tieset matrix using an example.
3. Consider a branch having impedance and a voltage source in series. State and derive the generalised network equilibrium equation in matrix form using KVL, in terms of tie-set matrix.
4. Identify and label all the cutsets in the given graph.



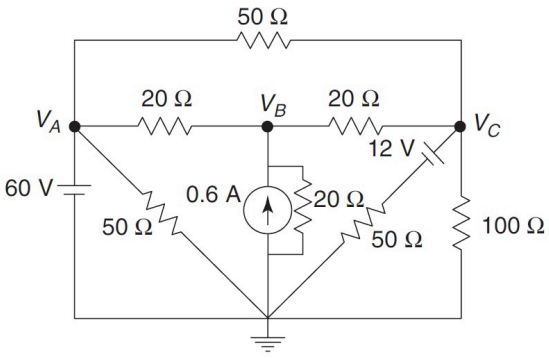
5. Define image transfer constant of a reciprocal two port network. State its equation in terms of T-parameters.
6. Derive the equivalent circuit of the two port network in terms of h-parameters.
7. Mention the restrictions on the pole and zero locations for transfer functions.
8. $H(s) = \frac{s}{s+\alpha}$ defines a network function. Obtain the pole-zero plot and impulse response for $\alpha = \pm 1$.
9. What does a constant term in the impedance function signify in network synthesis ?
10. State the properties of LC driving point immittance functions.

PART - B: 70 Marks (5 Qns x 14 Marks)

Answer any One full question from each module.

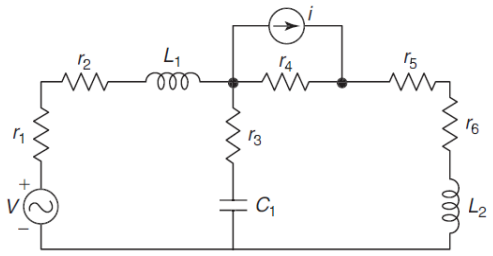
Module 1

11. Using node analysis, find voltage across the 100 Ω resistor for the network shown below.



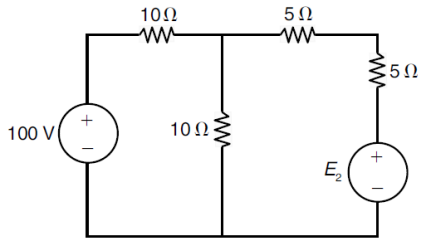
OR

12. Obtain the oriented graph, incidence matrix, reduced incidence matrix and the fundamental tie-set matrix of the following circuit by choosing a tree with the branch elements r_3, r_4. Also name all the possible loops in the graph.

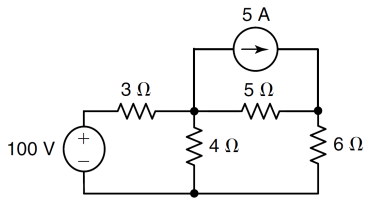


Module 2

13. a. Find the value of the source E_2 using Tellegen's theorem, if the power absorbed by E_2 is 20 W. (10 Marks)



b. Construct the dual of the network shown below. (4 Marks)



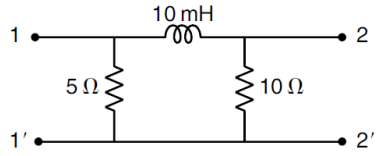
OR

14. From the reduced incidence matrix given, form the complete incidence matrix, draw the oriented graph and verify whether the cutset and tieset matrices are orthogonal or not.

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

Module 3

15. a. Derive the Z-parameters in s-domain for the following network (8 Marks)



b. Derive the Z parameters of a simple R-C high pass filter. (6 Marks)

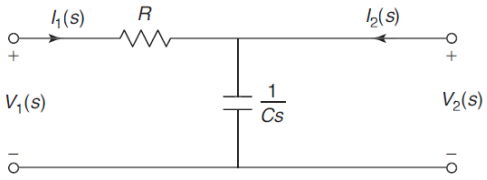
OR

16. a. Design a pi-type resistive attenuator to give 20 dB attenuation and to have a characteristic impedance of 100 Ω. (7 Marks)

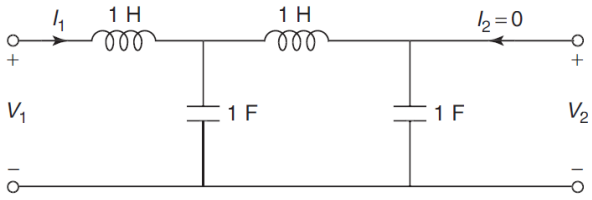
b. Design a constant-k high-pass filter having a cut-off frequency of 1 kHz with a load resistance of 600 Ω. (7 Marks)

Module 4

17. a. Derive the voltage transfer function of the given network. (4 Marks)



b. Determine the network functions: V_1/I_1, V_2/V_1 and V_2/I_1 for the given network. (10 Marks)



OR

18. a. Test whether the following function is Hurwitz, using the Routh array method (6 Marks)

$P(s) = s^5 + 12s^4 + 45s^3 + 60s^2 + 44s + 48$

b. Determine the range of values of "a" so that $P(s) = s^4 + s^3 + as^2 + 2s + 3$ is Hurwitz. (8 Marks)

Module 5

19. Realize Foster I and II forms of the following impedance function $Z(s) = \frac{4(s^2+1)(s^2+9)}{s(s^2+4)}$.

OR

20. Find the first and second Cauer forms of the following impedance function $Z(s) = \frac{2s^2+8s+6}{s^2+2s}$.

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