

[This question paper contains 5 printed pages.]

Your Roll No.

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MEE

Paper – EE.658

COMPUTER AIDED NETWORK DESIGN

Time : 3 Hours

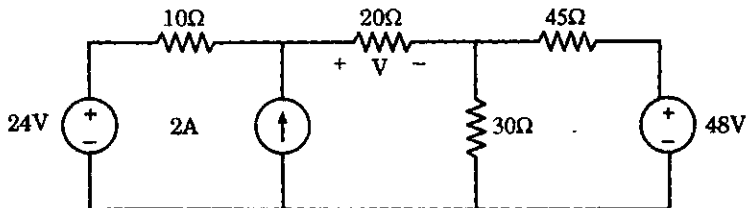
Maximum Marks : 100

(Write your Roll No. on the top immediately
on receipt of this question paper.)

Attempt any five questions.

All questions carry equal marks.

1. (a) Discuss mathematically how the process of network scaling affects impedances, frequencies and transducers. 8
- (b) A network function has the following roots : 4
Poles : $-1; -0.5 \pm 0.5j; 0.8 \pm 0.9j$
Zeros : $\pm 2.5j; \pm 4j$
- (c) For the electric network of Fig. 1, find voltage 'V'.



8

Fig. 1

[P. T. O.]

2. (a) Discuss the method of Gaussian elimination for solving a system of linear equations. Comment on the number of operations required by Gaussian Elimination. 8
- (b) Apply Cramer's rule to solve the following system of equations : 6

$$(i) \begin{bmatrix} 4 & 6 \\ 2 & 8 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

$$(ii) \begin{bmatrix} 2 & 4 & 6 \\ 6 & 4 & 2 \\ 1 & 8 & 4 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} = \begin{bmatrix} 4 \\ 12 \\ 13 \end{bmatrix}$$

- (c) Calculate LU factors of the following matrix : 6

$$\begin{bmatrix} 3 & 1 & 1 \\ 1 & 1 & 1 \\ 2 & 1 & 2 \end{bmatrix}$$

3. (a) Draw the hybrid π model for FET and BJT. Also write their nodal admittance matrices by inspection. 8
- (b) Write nodal admittance matrix for the network shown in Fig. 2 : 4

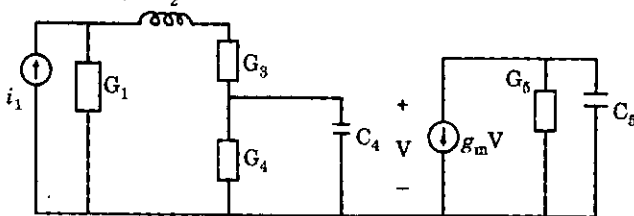


Fig. 2

- (c) Obtain mesh matrix equation for the network shown

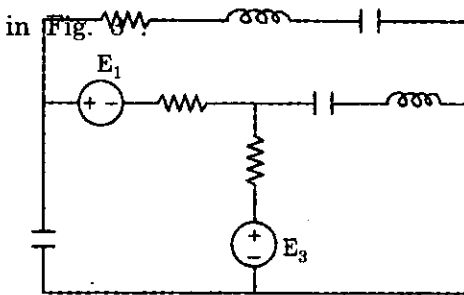


Fig. 3

4. (a) Prove the following standard results : 6

(i) $i = B^t i_C$

(ii) $v = Q^t v_l$

(iii) $YV_n = J_n$

where $Y = AYA^t$ and $J_n = -A_j J_D$

- (b) Derive the state variable formulation for the network shown in Fig. 4. Use the tree constituting the following elements :
- E, C_1
- and
- C_2
- . 14

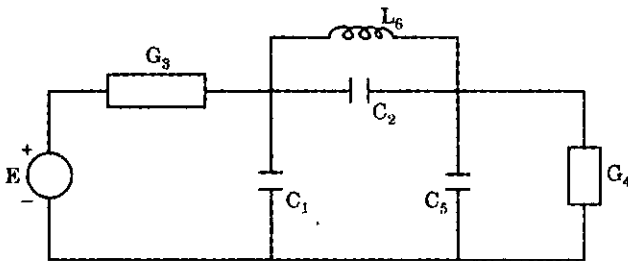


Fig. 4

5. (a) Consider the network shown in Fig. 5 and let the element values be $G_1 = G_2 = 1$ mho, $C_1 = C_2 = 1$ Farad and $A_1 = A_2 = \sqrt{1.9}$. Let all elements have tolerance of 1%. Illustrate the use of multiparameter sensitivity measures for network Q. 16

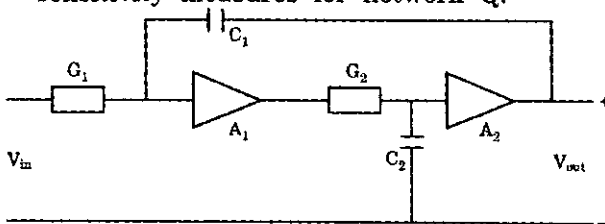


Fig. 5

- (b) Define normalized sensitivity. What is gain sensitivity product ? 4
6. (a) Discuss the numerical solution of the adjoint system used for evaluation of sensitivity of networks. 12
- (b) Find the sensitivity of the nodal voltages V_1, V_2 with respect to G_1 in the network of Fig. 6. 8

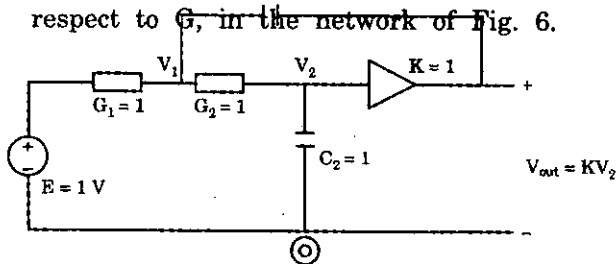


Fig. 6

7. Develop the modified nodal formulation for the network of Fig. 7 and compute matrix density D. 20

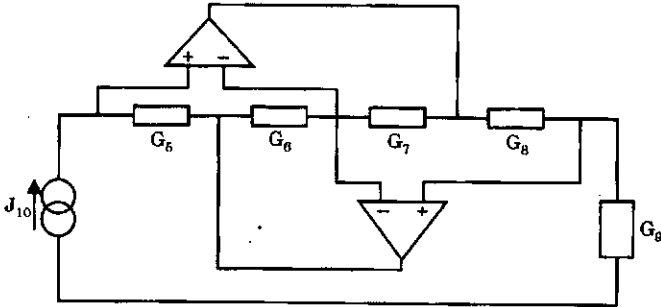


Fig. 7

8. (a) Discuss in details the Monte Carlo analysis of circuit design. 12
- (b) Apply N-R algorithm to the solution of the two diode network shown in Fig. 8. Let each diode be represented by $i_D = e^{40v_D} - 1$ and let initial estimations as $v_1^0 = v_2^0 = 0.1$ 8

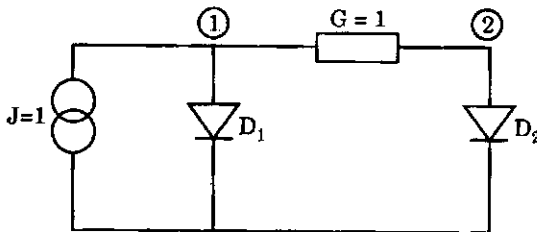


Fig. 8