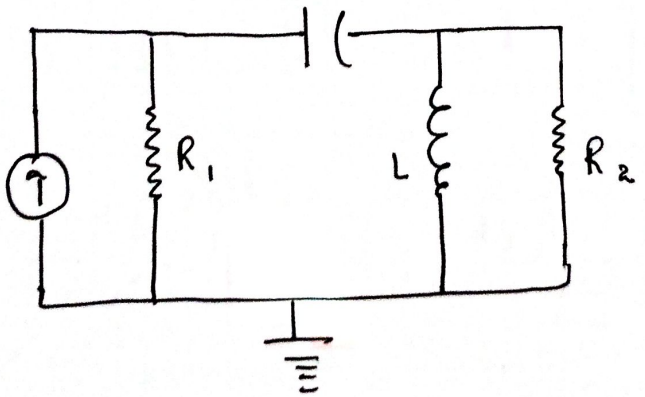
Q1

a) Node incidence matrix →

→ Each row represents node of the graph.
→ Each column represents a branch.
→ When a graph has N nodes and B branches, the node incidence matrix is N x B rectangular matrix.
→ oriented away – $a_{ij} = 1$
oriented towards – $a_{ij} = -1$
not incident – $a_{ij} = 0$

Loop incidence matrix →

→ Each row represents a loop.
→ Each column represents a branch.
→ A graph with N nodes and B branches → L x B rectangular matrix.
where L = no. of loops.
→ shows which branches are associated with the loop.



dual of the network is

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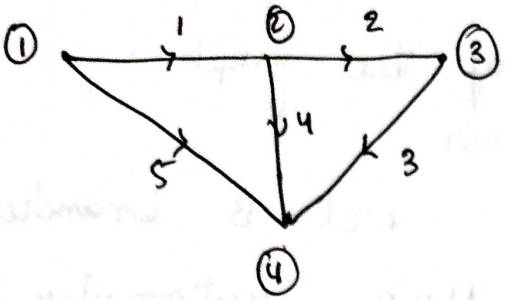
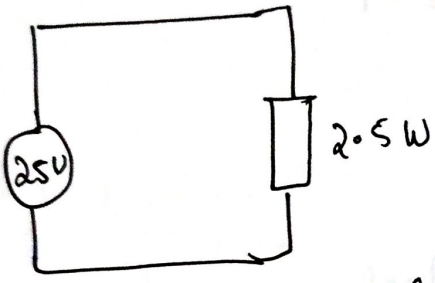
Example of Incidence matrix



$$[A] = \begin{array}{c} \\ 1 \\ 2 \\ 3 \\ 4 \end{array} \begin{array}{c} \begin{array}{ccccc} 1 & 2 & 3 & 4 & 5 \end{array} \\ \begin{bmatrix} 1 & 0 & 0 & 0 & 1 \\ -1 & 1 & 0 & 1 & 0 \\ 0 & -1 & 1 & 0 & 0 \\ 0 & 0 & -1 & -1 & -1 \end{bmatrix} \end{array}$$

(b)

1)



Thevenin voltage = 24 V

R_{TH} = 250 Ω

So, $R = \frac{V^2}{P} = \frac{25 \times 25}{2.5}$

= 250 Ω.

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