Paper 1 Group A, TDC Part-1
Solved Question of Previous Year- 2016
Lecture-2

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Q2) Explain node and mesh in electric circuit. How they are used in the analysis of an electric ckt?

Soln:→ Node is a point in a electric circuit where 2 or more elements are connected together.

For example consider the electrical ckt shown in figure 2(a)

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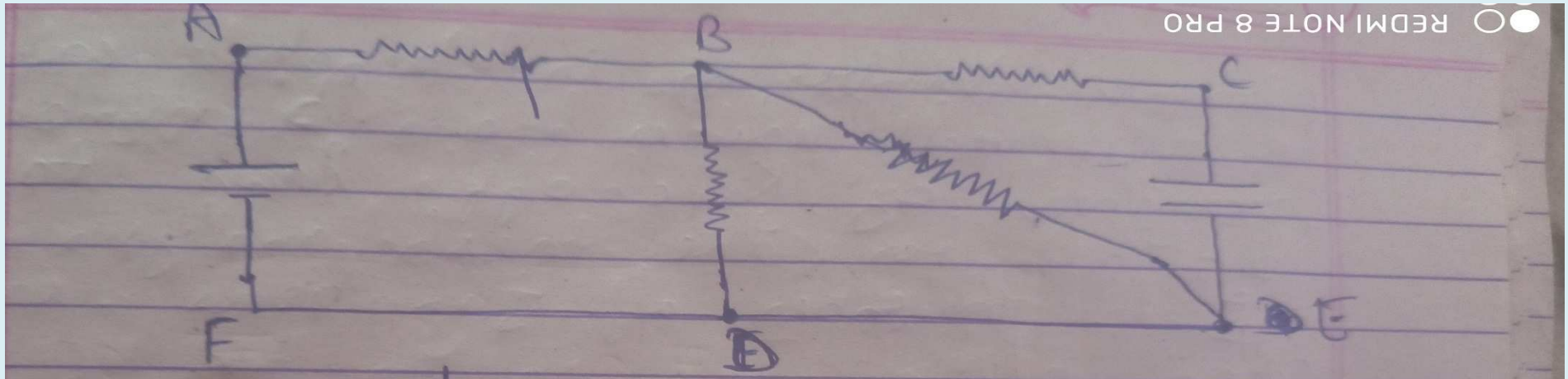

figure 2 (a)

In the electric circuit shown in figure 2(a) A, B, C, [redacted] E are the nodes.

Mesh → A loop (closed path for the flow of current in the ckt.) that does not contain any other loops within it, is called a mesh

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For Example in figure 2(a), ABDFA, BEDB, & BCEB are the meshes

Mesh and node analyses are used to analysis coupled circuits.

In mesh analysis method, mesh currents are employed. Currents in different meshes are assigned continuous paths so that they do not split at a junction into branch currents.

Then the loop voltage equations by Kirchoff's voltage law in terms of unknown loop

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currents. Number of independent currents to be solved reduces from b (number of branches) by Kirchoff's laws to 'b-(j-1)' for the mesh analysis method. j is number of junctions in a given n/w.

Example:->

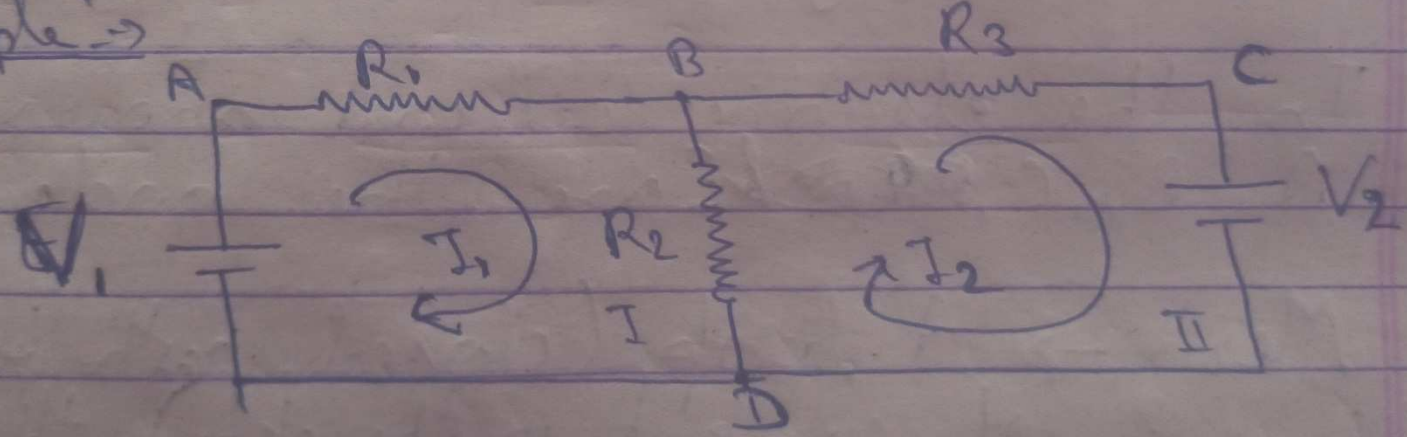

Figure 2.1

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Consider a coupled ckt. shown in fig with 2 voltage sources V_1 & V_2 and 3 resistors. There are two meshes ABDA & BCDB with mesh current I_1 & I_2 respectively. In mesh ABDA the current through R_1 is I_1 and through R_2 is $(I_1 - I_2)$. Similarly in mesh BCDB the current through R_3 is I_2 and through R_2 is $(I_2 - I_1)$. R_2 is common to both meshes, so we consider it for both meshes.

Now applying KVL to the mesh ABDA & BCDB we get,

$V_1 - I_1 R_1 - (I_1 - I_2) R_2 = 0$ ---- mesh ABDA

or, $I_1 (R_1 + R_2) - I_2 R_2 = V_1$ ---- (i)

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Hardy $-I_2 R_3 - V_2 + (I_2 - I_1) R_2 = 0$

or, $I_1 R_2 - I_2 (R_2 + R_3) = V_2$

The above equations can be solved to find the mesh current as well as branch current. Therefore responses in different branches can be obtained using Mesh analysis method.

Node Analysis :- The node - analysis is based on Kirchoff's current law. This method is particularly suited for networks having many Nol circuits with common ground connected. In this we consider a reference node in the network and then finding the unknown voltages at the nodes with respect to the reference node.

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we consider a reference node in network and then finding the unknown voltages at the nodes with respect to the reference node.

Example:- Again consider the same ckt of figure 2.1

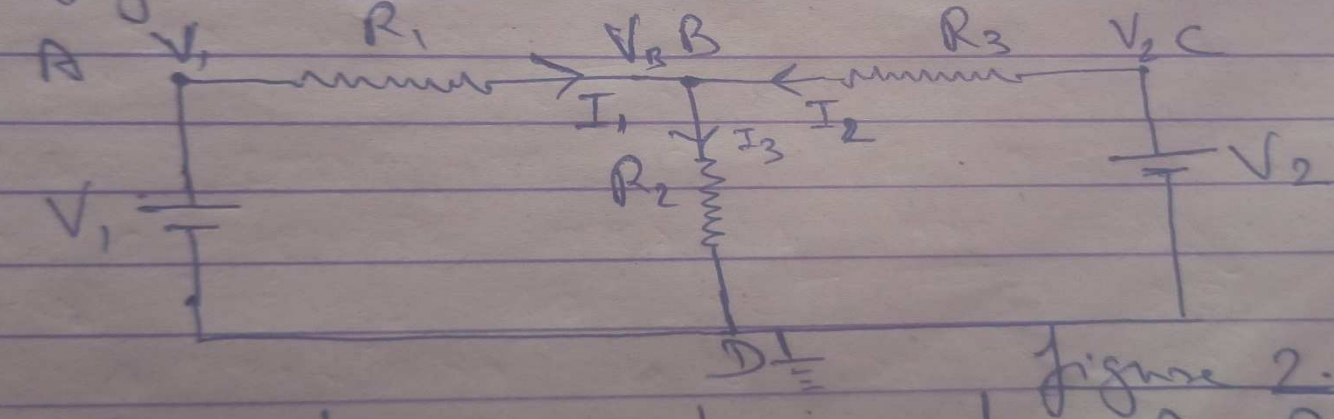

figure 2.2

In above figure we have nodes - A, B, C & D Voltage at node A is V_1 and at node B is V_2 while at node D is at ground (i.e. reference node)

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So we have unknown voltage at node B. Consider voltage at node B as V_B.

Now applying KCL at node B., we have current I_1 & I_2 entering and current I_3 leaving the node so as per KCL at node B.

$$I_1 + I_2 = I_3$$

$$\frac{V_1 - V_B}{R_1} + \frac{V_2 - V_B}{R_3} = \frac{V_B}{R_2} \quad \text{——(i)}$$

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When the value of V_1, V_2, R_1, R_2 & R_3 are given then voltage at node B (V_B) can be obtained by solving by eqn. (i) by placing all the values. Hence we can find current I_1, I_2 & I_3. Here nodal analysis is more easy than mesh analysis. So in most of the cases the no. of equations for Nodal Analysis is less than mesh analysis method.

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Improper visible words in different pages-

It is ‘independent equations’ at page 5.

It is ‘shown in figure 2.1.’ and other is ‘V_1 & V_2 and 3 resistors at page 6.

It is ‘------ mesh BCDB’ at page 7.

The unclear word of page 8 is also available in page 7.

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The same PDF can also be seen on L.S. College website.

Solution for other question will also be provided

For any query contact- 9771474020

Thank You