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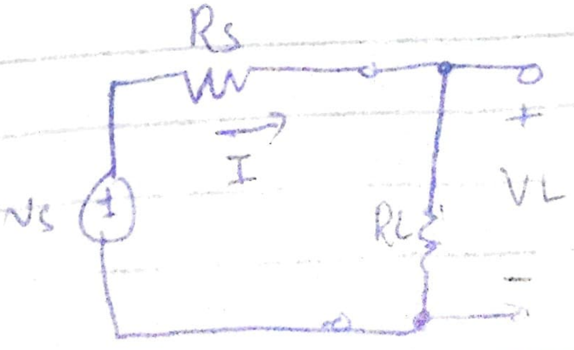
Subject = linear circuit Analysis.

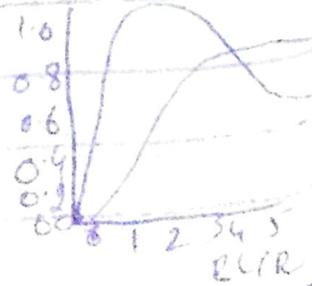
Question No#1

Maximum power transfer theorem :-

In electrical engineering the maximum power transfer theorem states that "to obtain maximum external power from a source with a finite internal resistance, the resistance of the load must equal the resistance of the source as viewed from its output terminals.

The theorem results in maximum power transfer across the circuit and not maximum efficiency. If the resistance of the load is made larger than the resistance of the source then efficiency is higher. If the load resistance is smaller than the source resistance then most of the power ends up being dissipated in the source as although the total power dissipated is higher, due to a lower total resistance, it turns out that the amount dissipated in the load is reduced.

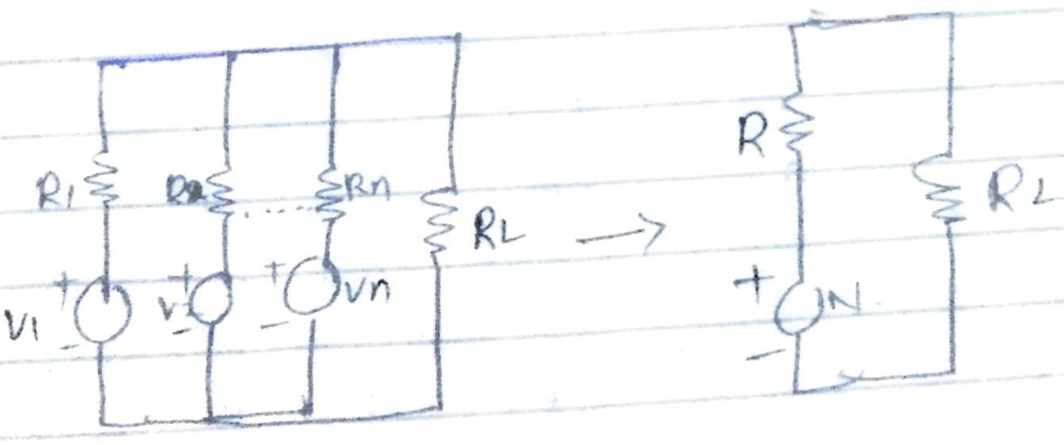




Millman's theorem

Millman's theorm or the parallel generator theorem is a method to simplify the salution of a circuit specifialy, Millman's theorem is used to compute the valltage at the ends of a circuit made up of only branches in parallel.

The millman's theorem states that, when a number of valteges sources (V_1, V_2, V_3 ..... V_n) are in parallel having internal resistance (R_1, R_2, R_3 ... R_n) respectively, the arrangment can replace by a single equivalent valtage source V in series with an equivalent series resistance R



As Millman's theorem

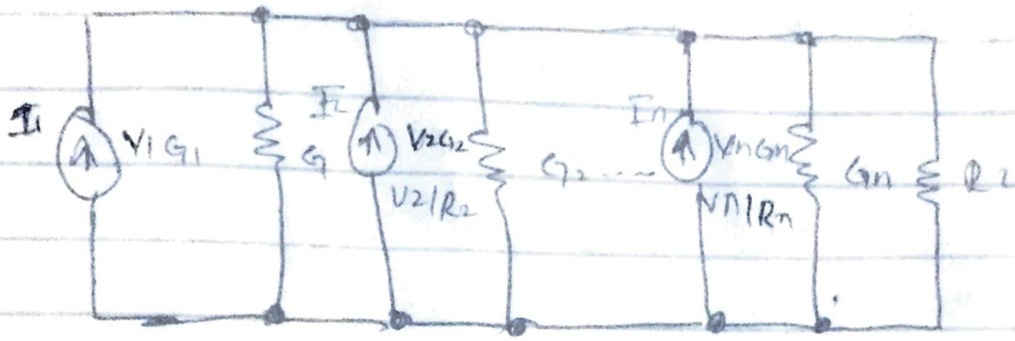
$$V = \frac{\pm V_1G_1 \pm V_2G_2 \pm \dots \pm V_nG_n}{G_1 + G_2 + \dots + G_n}$$

Now

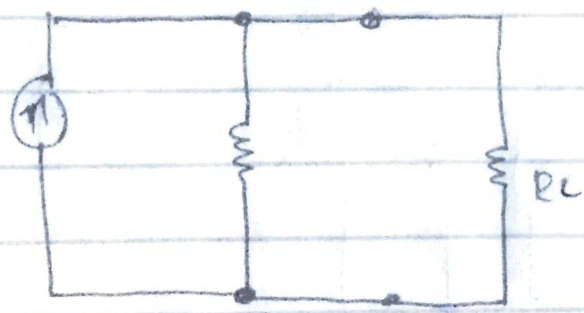
$$R = \frac{1}{G} = \frac{1}{G_1 + G_2 + \dots + G_n}.$$

Explanation of theorem:

Assuming a DC network of numerous parallel voltage sources with internal resistance supplying power to a load resistance R_L as shown.



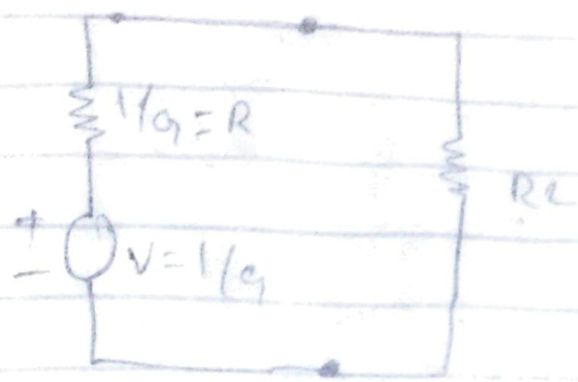
let I Represent the resultant current of the parallel current sources wile G the equivalent conductance



$I = I_1 + I_2 + I_3 \dots$ and

$G = G_1 + G_2 + G_3 + \dots$

Next the resulting current source is converted to an equivalent voltage source.



THUS

$$V = \frac{1}{G} = \frac{\pm I_1 \pm I_2 \pm \cdots \pm I_n}{G_1 + G_2 + \cdots + G_n}.$$

Also

$$R = \frac{1}{G} = \frac{1}{G_1 + G_2 + \cdots + G_n}.$$

And we know.

$I = V/R$ so $R = I/G \Rightarrow G = I/R$

the equation.

$$V = \frac{\pm \frac{V_1}{R_1} \pm \frac{V_2}{R_2} \pm \cdots \frac{V_n}{R_n}}{\frac{1}{R_1} + \frac{1}{R_2} + \cdots \frac{1}{R_n}}$$

thus.

$$V = \frac{\sum_{k=1}^{n} V_k G_k}{\sum_{k=1}^{n} G_k}$$ and $G_k = 1/R_k$

3) Super Node :→

A super node is a theoretical construct ~~of~~ that can be used to solve a circuit. Each super node contains two nodes one non-reference node and another node that may be a second non refrence node or the refrence node. super nodes containing the refrence node have one node voltage Variable. this is done by viewing a voltage source on a wire as a point source voltage in relation to other point voltages located at various nodes in the circuit. relative to a ground node assigned a zero or negative charge. super nodes are used to do nodal analysis on circuits containing voltage sources, you would make a super node from each pair of nodes that are connected by a voltage source, since you ask specifically about super mesh. construct is only required two non-reference nodes

RMS value :-

Root mean square (Rms) is defined as the square root of mean square value of a set of values or a (continous time waveform) is the square root of the arthemtic mean of the square of the value of the square of the function that is the square of the continous wave form. RMS defines the current value can also be define as the value of the direct current that dissipates the same power in a resistor.

In the case of a set of n values $\{x_1, x_2 \dots x_n\}$ the Rms is

$$x_{Rms} = \sqrt{\frac{1}{n}(x_1^2 + x_2^2 + \dots + x_n^2)}$$

The corresponding formula is for a continous function (or wave form) $f(t)$ defined over the interval $T_1 \le t \le T_2$ is

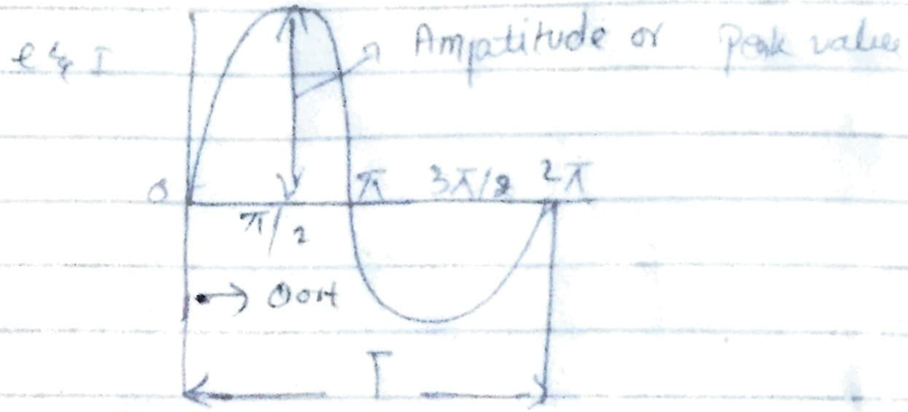
$$f_{Rms} = \sqrt{\frac{1}{T_2 - T_1}\int_{T_1}^{T_2} [f(t)]^2 \, dt}$$

$$f_{Rms} = \lim_{T \to \infty} \sqrt{\frac{1}{T}\int_0^T [f(t)]^2 \, dt}$$

The Rms over all time is equal to Rms of one period of

Maximum value:

The maximum value attained by an alternating quantity during one cycle is called a peak value. It is also known as the maximum value or amplitude or crest value. The sinusoidal alternating quantity attains its peak value at 90 degrees. The peak value of alternating voltage and current is represented by Em and Im respectively



Average value:

The average of all the instantaneous values of an alternating voltage and currents over one complete cycle is called Average value. If we consider wave like sinusoidal current or voltage wave form the positive half cycle will be exactly equal to the negative half cycle the average value over cycle will be zero

Active & Passive Elements

Active elements are the devices which are capable of providing or delives energy to the circuit. Passive elements are the devices which do not require an external source for the operation and are capable of storing energy in the form of valtage or corrent in the circuit

Active elements are those which dilivers or produce energy or power in the form of a valtage or corrent passive are those who utilies or store energy.

Active elements are capable of provide the power again. passive elements are not capable to provide the power again.

Active can control the flow of corrent passive elements cannot control the flow of current.

Active elements requires an external sorce for the operation, passive elements doesnot require an external source for operation

Active are energy doner and passive are not energy doner