Sumedh

General formulae

① Ohm's law

$V = IR$; $V/I = R$, $V/R = I$

② Power

$P = VI = I^2R = \frac{V^2}{R}$

③ Energy

$E = P \times t = VIt$

④ Res. in series

for same I , diff V

$E = V_1 + V_2 + \ldots\ldots$

$= R_1 I + R_2 I + \ldots\ldots$

$E = (R_{eq}) I$

⑤ Voltage division rule

$I = \frac{E}{R_1 + R_2}$

$\therefore V_1 = \frac{R_1}{R_1 + R_2} E$; $V_2 = \frac{R_2}{R_1 + R_2} E$

I

⑥ Res in parallel

for same V , diff I

$I = I_1 + I_2 + \ldots\ldots$

$= \frac{E}{R_1} + \frac{E}{R_2}$

$I = \frac{E}{R_{eq}}$

[V= E = same same & not diffelent]

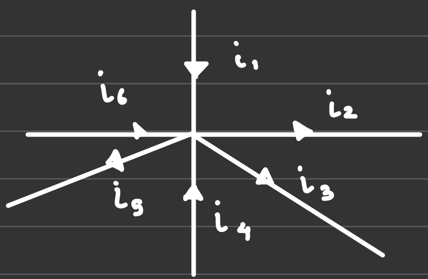
⑦ Current division rule

$$E = \overbrace{\left(\frac{R_1 R_2}{R_1 + R_2}\right)}^{R_{eq}} I$$

$$\therefore \quad \underbrace{I_1}_{E/R_1} = \frac{R_2}{R_1 + R_2} I \quad ; \quad I_2 = \frac{R_1}{R_1 + R_2} I \qquad \equiv \qquad \frac{I\, R_{eq}}{R + R_{eq}}$$

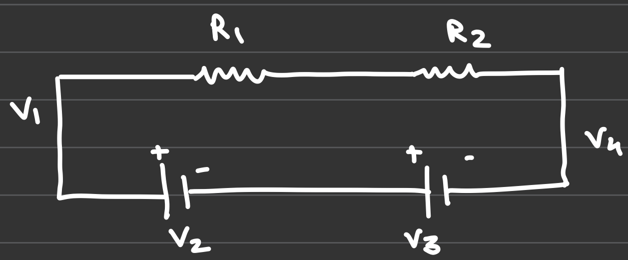
⑧ KCL

The algebraic sum of all currents through a junction is zero



⑨ KVL

The algebraic sum of elements voltages around a closed loop is zero



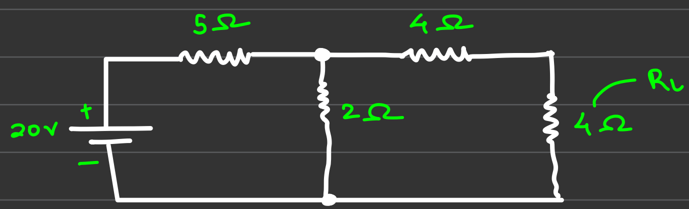
$$V_1 - V_2 - V_3 + V_4 = 0$$

- Network theorems

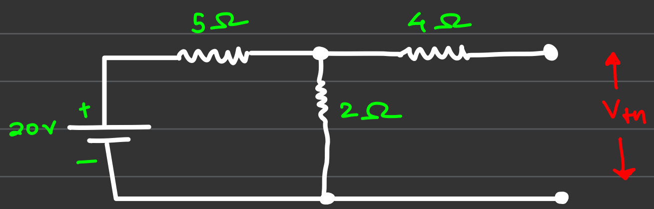
① Thevenin's theorem

Converts complex network to simple circuit

Steps :-



1. Disconnect the loat resistance and make its terminals open



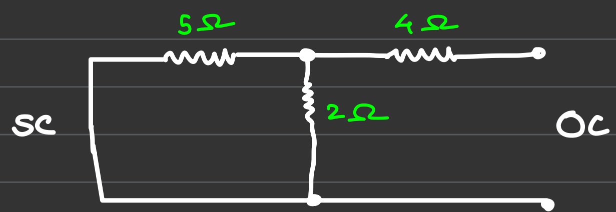
2. find V_{th}

→ $R_{eq} = 5+2 = 7\ \Omega$ (4Ω is oc)

$I = 20/7 = 2.8\ A$

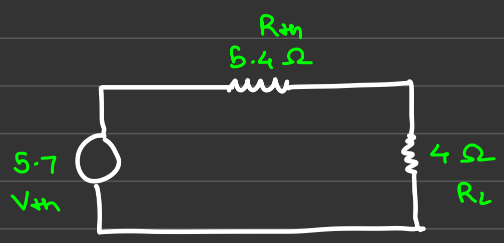
Now , $V_{th} = V_{2\Omega} = 2.8 \times 2$
$= 5.7\ V$

3. find R_{th} by SC the Voltage source and OC current source



$R_{th} = (5 \parallel 2) + 4$
$= 5.4\ \Omega$

4. Draw the thevenin eq. circuit and place the disconnected R_L at the same place



5. find current through R_L

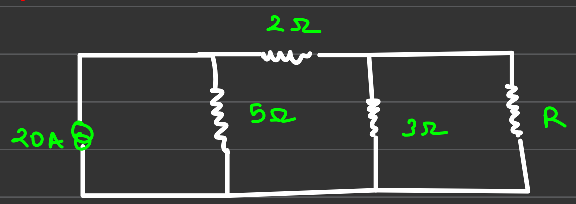
$$I_L = \frac{I R_{th}}{R_L + R_{th}} = \frac{V_{th}}{R_{th} + R_L}$$

$$= \frac{5.7}{5.8 + 4} = 0.6\,A$$

③ Maximum Power transfer theorem

max P tranfer frm source to load occurs when $\boxed{R_L = R_{th}}$

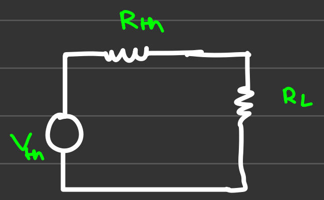
Steps :-



1. first 3 steps same as thevenin's thm

$V_{th} = 30$ volts
$R_{th} \approx 2.1\ \Omega$

4. Reconnect R_L and draw thevenin's eq



here

$R_L = R_{th} = 2.1\ \Omega$ (MPT)

5. find I_L and P_{max}

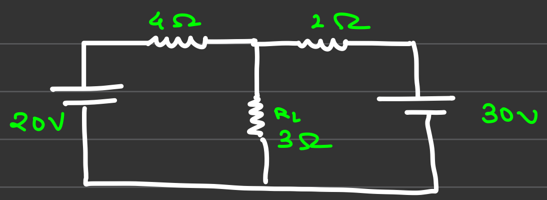
$$I_L = \frac{V_{th}}{R_L + R_{th}} = \frac{V_{th}}{2R}$$

$$P_{max} = \frac{V_{th}^2}{2(2R)} = \frac{V^2}{4R}$$

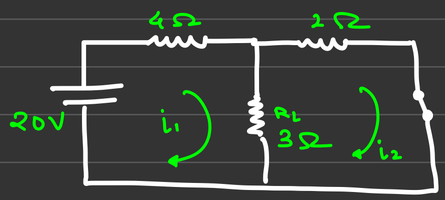
③ Superposition theorem

I or V in any element is equal to the algebraic sum of current or Voltage that would have been produced by individual circuits

Steps :-



1. Consider any 1 source of V or I, replace other sources by SC / OC



- AC Circuits

i) Basic terms
ii) Average value
iii) RMS
iv) Single phase
v) Analysis
vi) Three-phase

- Basic terms

3. *Periodic Waveform* Periodic waveform is one which repeats itself after definite time intervals.

4. *Sinusoidal and Non-Sinusoidal Waveform*

Sinusoidal waveform It is an alternating waveform in which sine law is followed.

Non-sinusoidal waveform It is an alternating waveform in which sine law is not followed.

5. *Cycle* One complete set of positive and negative halves constitute a cycle.

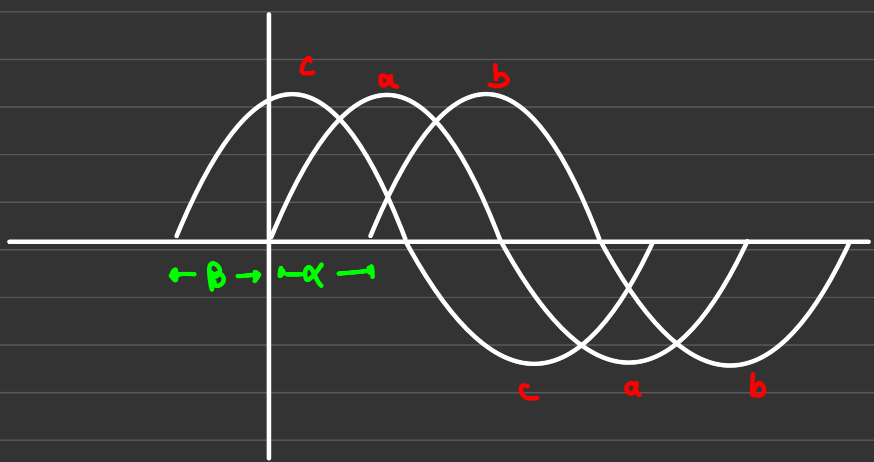
6. *Amplitude* The maximum positive or negative value of an alternating quantity is called the amplitude.

7. *Frequency* The number of cycles per second of an alternating quantity is known as frequency. Unit for frequency is expressed as c/s or Hertz (Hz).

8. *Period (T)* Time period of an alternating quantity is the time taken to complete one cycle. Time period is equal to the reciprocal of frequency. Time period is expressed in secs.

9. *Phase* The phase at any point on a given wave is the time that has elapsed since the quantity has last passed through zero point of reference and passed positively.

10. *Phase Difference* The term is used to compare the phase of two waveforms or alternating quantities.



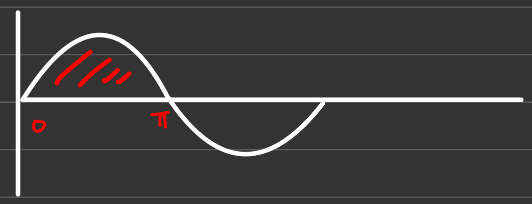
$e_A = E_m \sin \omega t$

$e_B = E_m \sin(\omega t + \beta)$ (leads)

$e_C = E_m \sin(\omega t - \alpha)$ (lags)

- **Avg Value**

The steady current that is transferred across a circuit the same charge as AC in same time



$$I_{av} = \int_0^{\pi} \frac{i.d\theta}{2\pi}$$

$$= \int_0^{\pi} \frac{I_m \sin\theta . d\theta}{\pi}$$

$$= \frac{I_m}{\pi} \left[-\cos\theta \right]_0^{\pi}$$

$$= \frac{2 I_m}{\pi}$$

$I_{av} = 0.637\ I_m$

- **RMS Value**

$\int i/\theta$

rest ppt