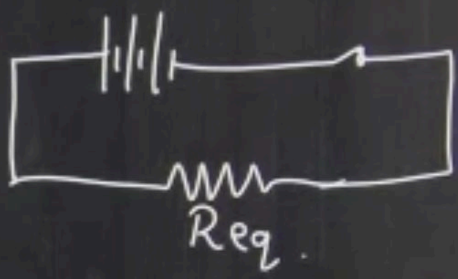
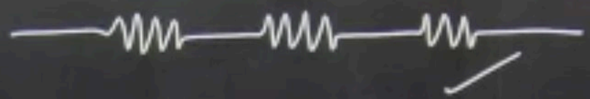
What is equivalent circuit ?

If more than two passive elements are connected in any combination then the combined effect of the connection can be represented by single equivalent passive element in the same circuit. Hence the circuit is known as equivalent circuit.

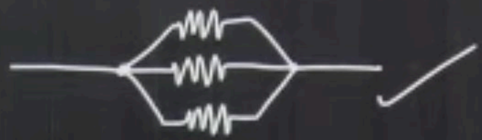


09:37

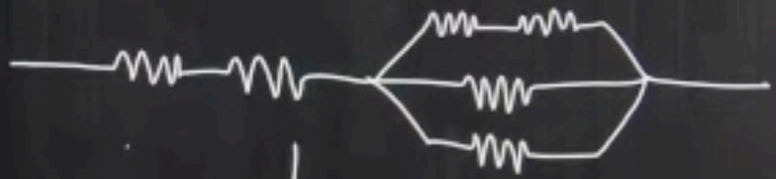
Series equivalent



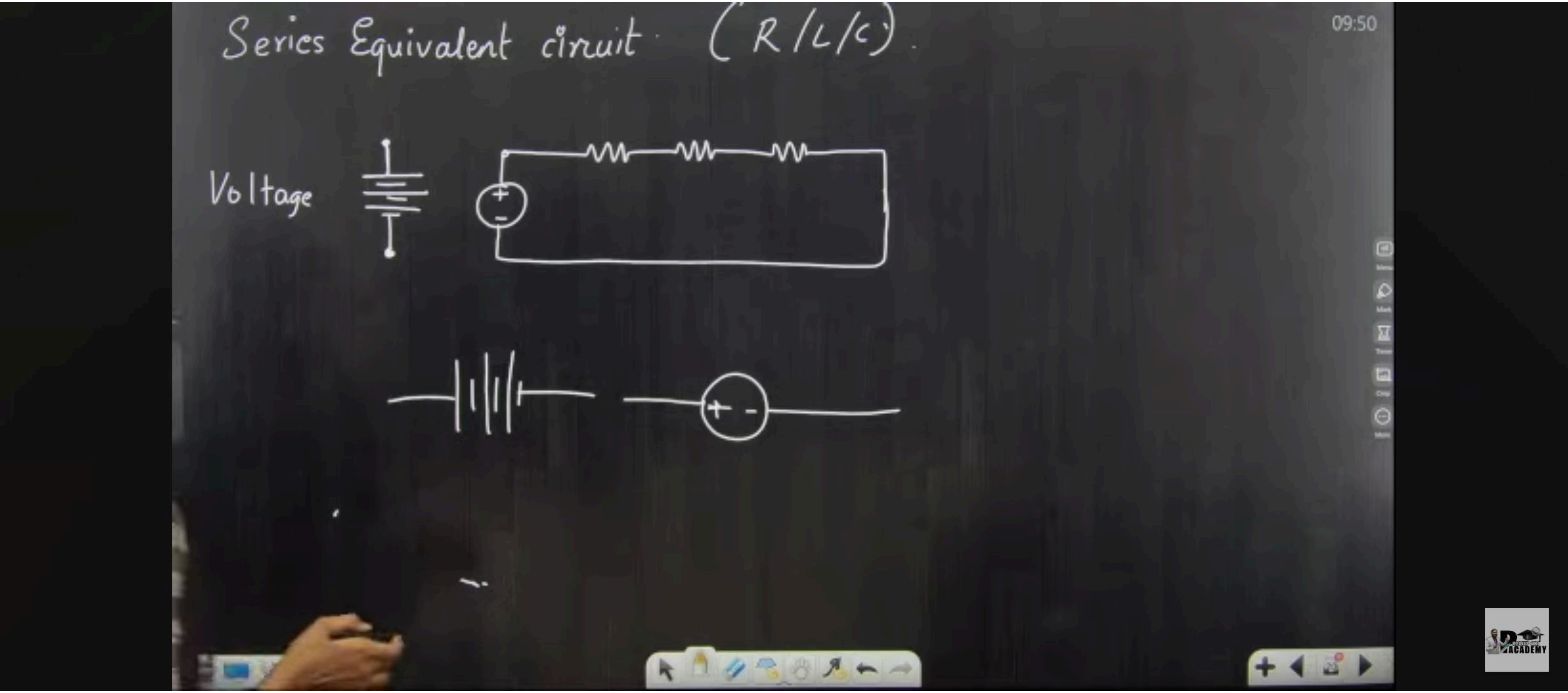
Parallel equivalent



Series + Parallel

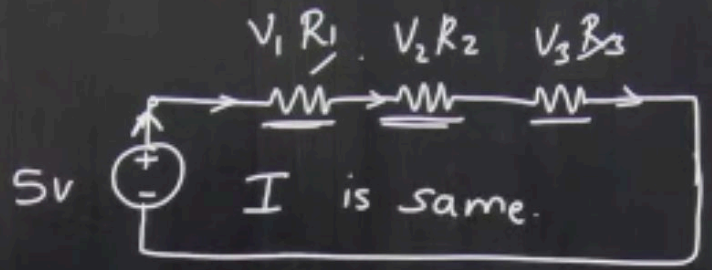


Star delta transformation



Series Equivalent circuit (R/L/C).
Voltage
09:50
ACADEMY

Series Equivalent circuit (R/L/C).

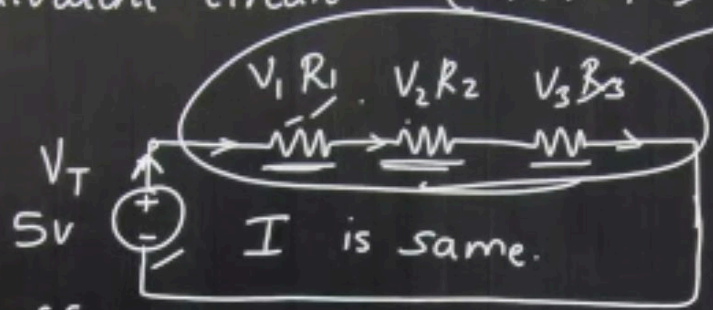


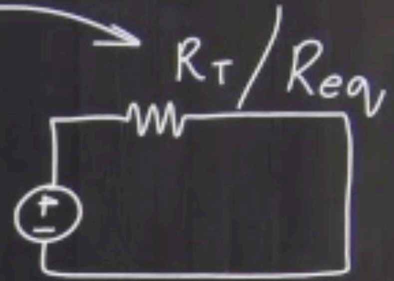
Voltage is different for each passive element [Resistors].

KVL.

$5V = V_1 + V_2 + V_3$.

Series Equivalent circuit (R/L/C).





oltage is different for each passive element [Resistors].

KVL.

$5V = V_1 + V_2 + V_3$.

$$V_T = V_1 + V_2 + V_3 \text{ — [by KVL]}$$

$$IR_T = IR_1 + IR_2 + IR_3$$

$$\cancel{I}R_T = \cancel{I}(R_1 + R_2 + R_3)$$

$V \propto I$

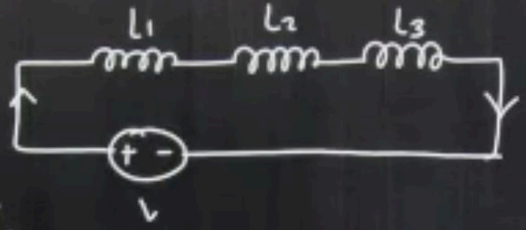
$V = IR$ — by ohm's law

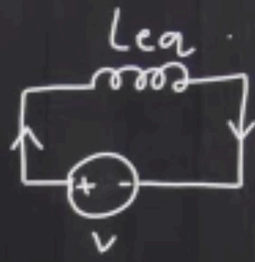
$$\boxed{R_T = R_1 + R_2 + R_3}$$

$SV = V_1 + V_2 + V_3$.

$\boxed{R_T = R_1 + R_2 + R_3} \cdots\cdots R_n$

When Inductors are connected in series.





$$L_{eq} / L_T = L_1 + L_2 + L_3 \cdots\cdots L_n$$

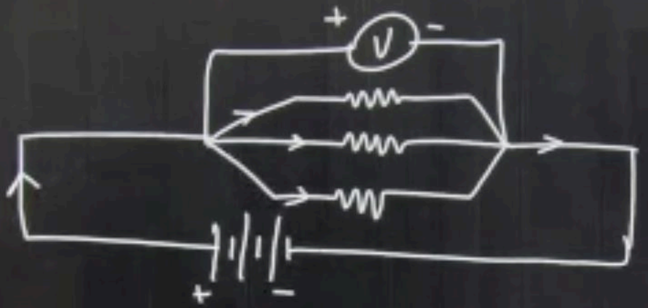
When Capacitor is connected in series.

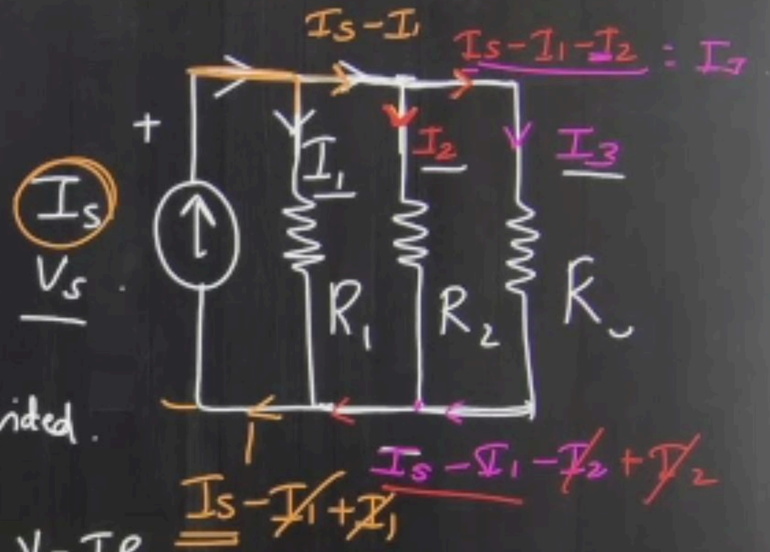
$$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \cdots\cdots + \frac{1}{C_n}$$

10:12

Parallel Equivalent Circuit

When resistor is connected in parallel





Voltage remains same → Current is divided.

$$I_s = I_1 + I_2 + I_3$$

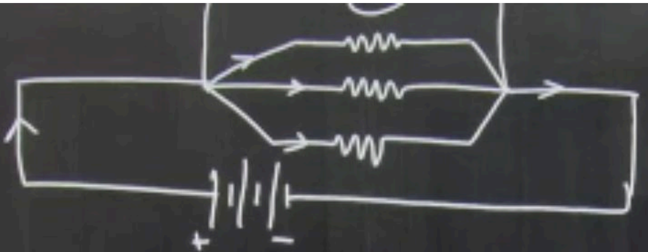
$$\frac{V}{R_{eq}} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$$

$$\frac{\cancel{V}}{R_{eq}} = \cancel{V}\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right)$$

$$V = IR$$

$$I_n = \frac{V}{R_n}$$

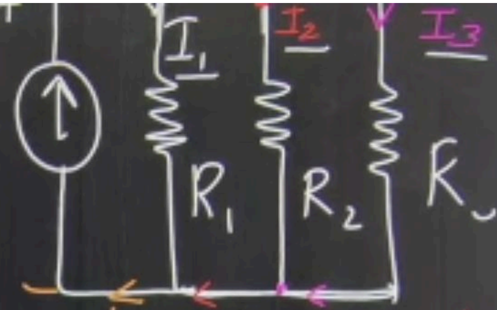
10:12



Voltage remains same → Current is divided.

I_s

V_s



$I_s - \cancel{I_1} + \cancel{I_1}$

$I_s - I_1 - \cancel{I_2} + \cancel{I_2}$

$$I_s = I_1 + I_2 + I_3.$$

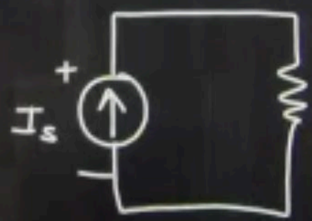
$$\frac{V}{R_{eq}} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$$

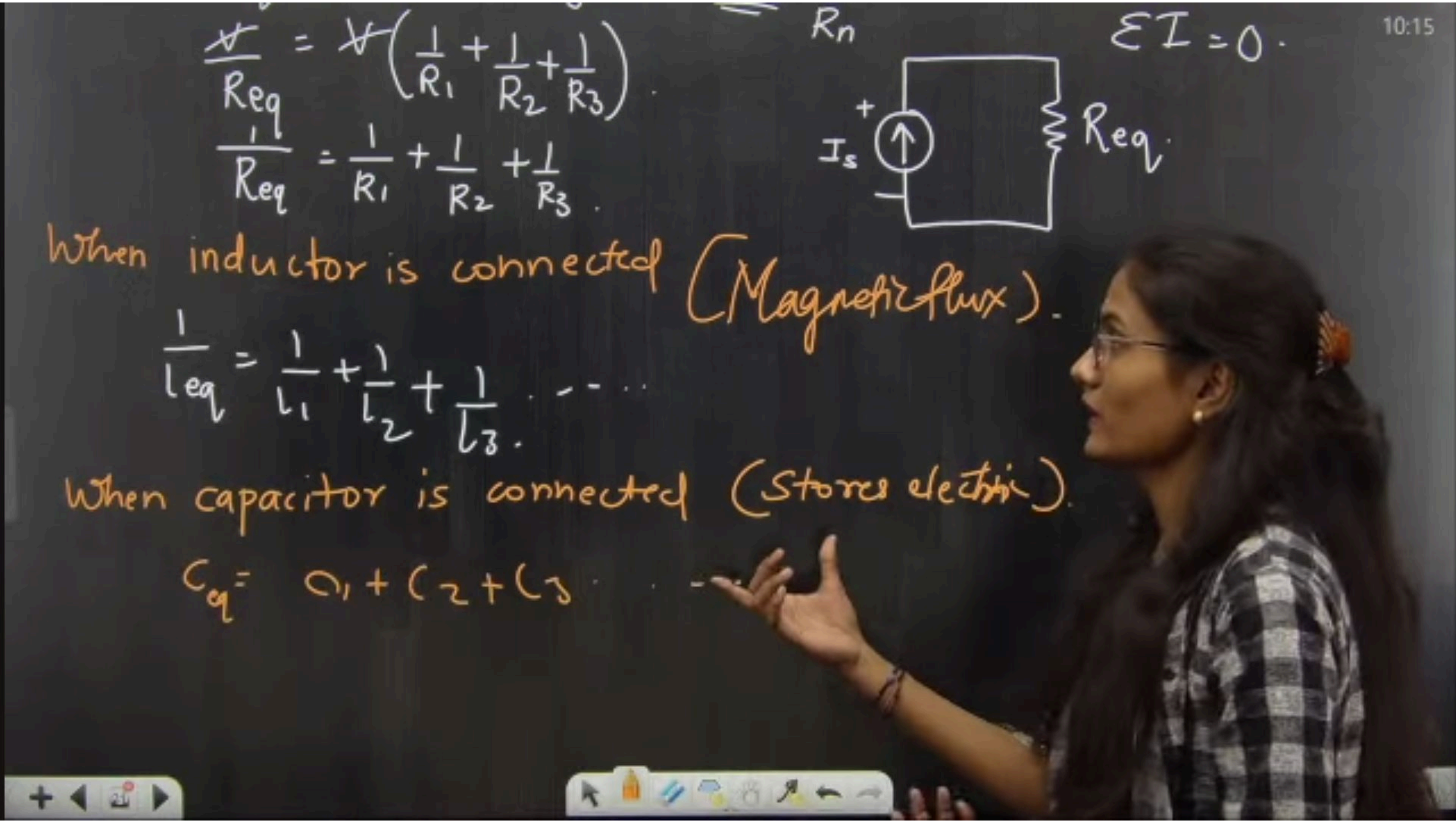
$$\frac{\cancel{V}}{R_{eq}} = \cancel{V}\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right).$$

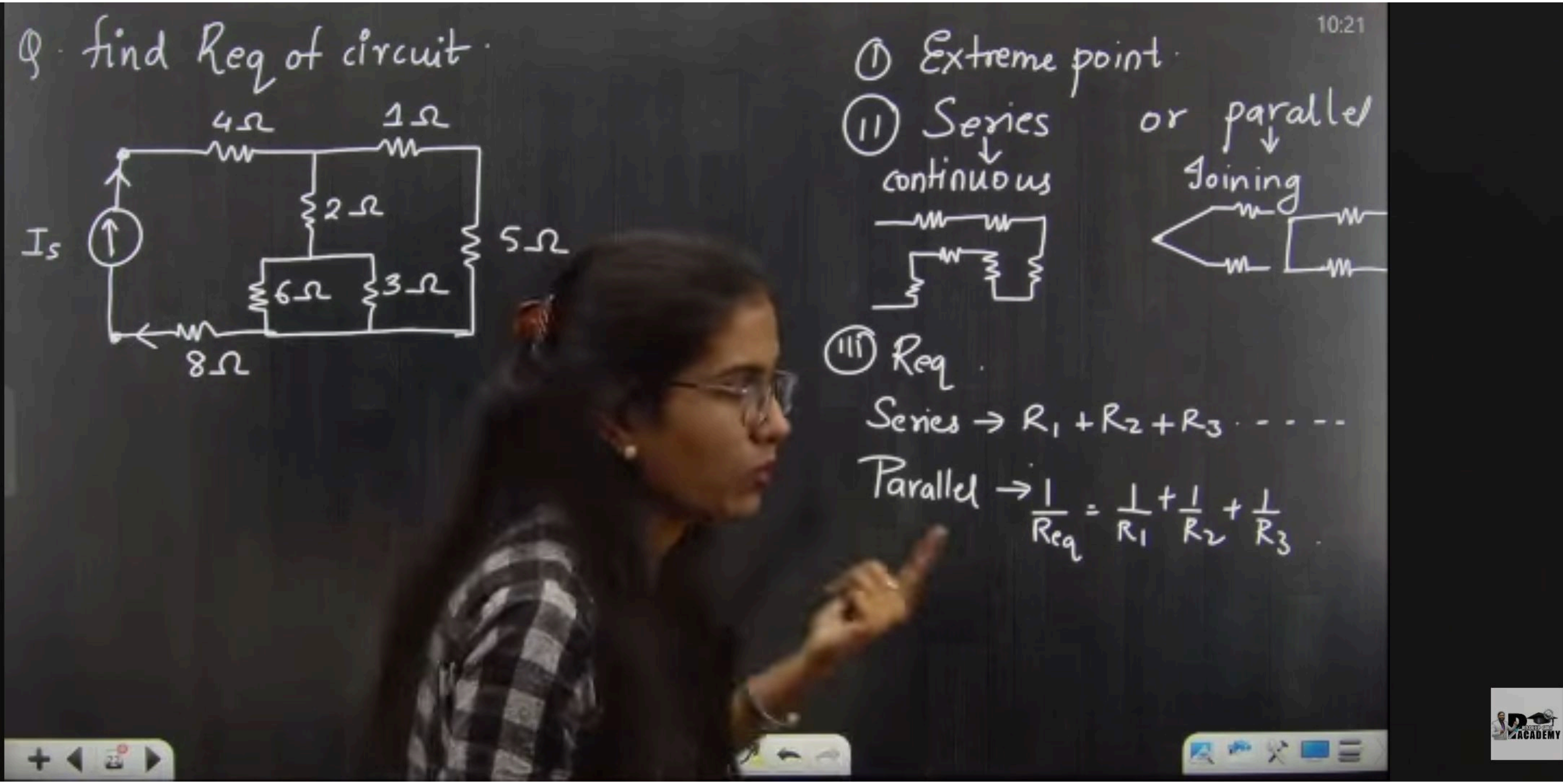
$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}.$$

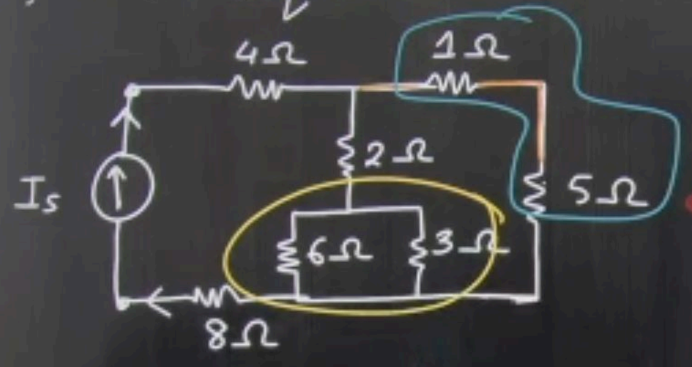
$V = IR.$

$I_n = \dfrac{V}{R_n}$




10:15
$\frac{V}{R_{eq}} = V\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right)$
$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$
R_n
$\Sigma I = 0$
I_s
R_{eq}
When inductor is connected (Magnetic flux).
$\frac{1}{L_{eq}} = \frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3} \ldots$
When capacitor is connected (Stores electric).
$C_{eq} = C_1 + C_2 + C_3 \ldots$


Q. find Req of circuit.
4Ω
1Ω
2Ω
Is
5Ω
6Ω
3Ω
8Ω
(i) Extreme point.
(ii) Series or parallel
continuous
Joining
(iii) Req.
Series → R1 + R2 + R3 ....
Parallel → 1/Req = 1/R1 + 1/R2 + 1/R3.
10:21
ACADEMY



$1\Omega + 5\Omega = 6\Omega$ [Series]

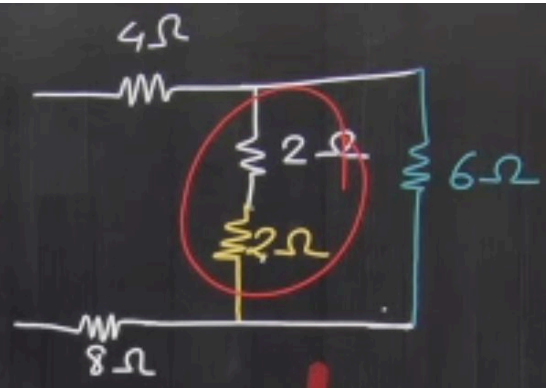
$6\Omega \parallel 3\Omega$

$$\frac{1}{R_{eq}} = \frac{1}{6} + \frac{1}{3}$$

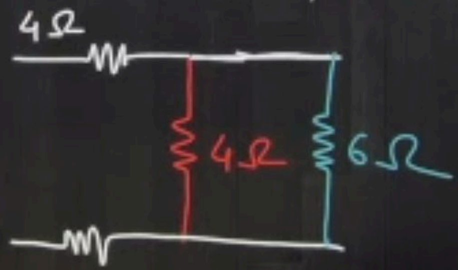
$$\frac{1}{R_{eq}} = \frac{1}{2}$$

reciprocal

$$R_{eq} = 2$$



$2+2=4\Omega$



(i) Ext…

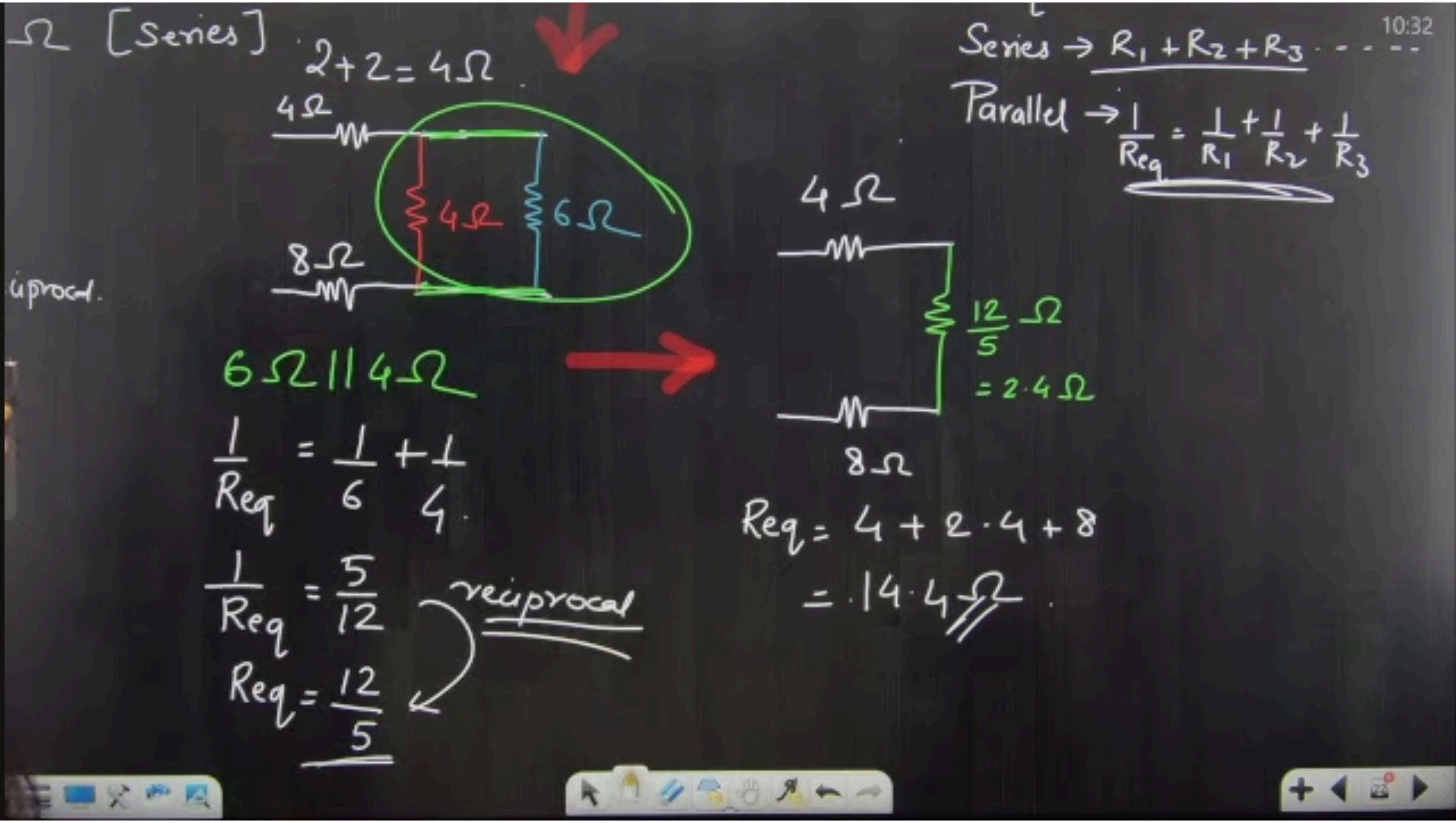
(ii) Se…

continu…

(iii) Req

Series -

Parallel


Ω [Series]
2+2=4Ω
4Ω
4Ω
6Ω
8Ω
ciprocal.
6Ω||4Ω
1/Req = 1/6 + 1/4
1/Req = 5/12
reciprocal
Req = 12/5
Series → R1 + R2 + R3 .....
Parallel → 1/Req = 1/R1 + 1/R2 + 1/R3
4Ω
12/5 Ω
= 2.4Ω
8Ω
Req = 4 + 2.4 + 8
= 14.4Ω
10:32