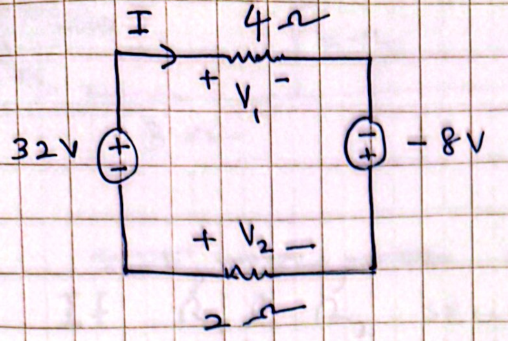
Analog Electronics - I   Assignment 1.   Madushan Rajapaksha.

(1)



Consider Current I is flowing through the circuit.

So $V_1 = I \times 4\,\Omega = 4I \rightarrow (1)$

$V_2 = (-I) \times 2\,\Omega = -2I \rightarrow (2)$

Apply KVL 2)

$$-32V + V_1 - (-8V) - V_2 = 0$$

$$V_1 - V_2 = 24V \rightarrow (3)$$

substitute (1) & (2) to equation (3)

$$4I - (-2I) = 24V$$

$$6I = 24V$$

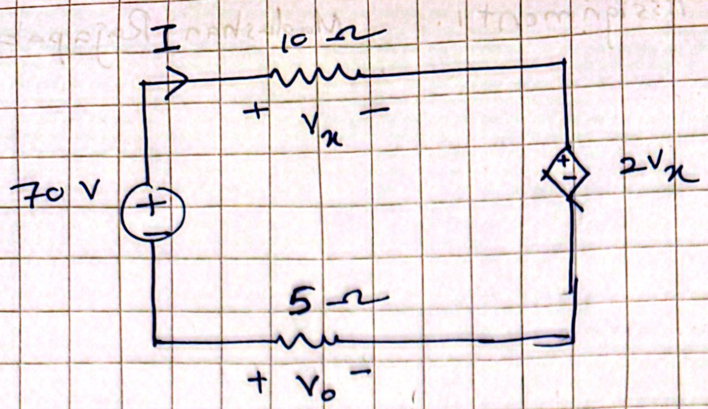
$$\boxed{I = 4A}$$

So substitute $I = 4A$ to eq (1) & eq (2)

$$V_1 = 4(4) = 16V$$

$$V_2 = 4(2) = 8V$$

②



consider current I is flowing through the circuit.

So $V_x = 10I$

$V_o = -5I$

Apply KVL ↻ ⇒

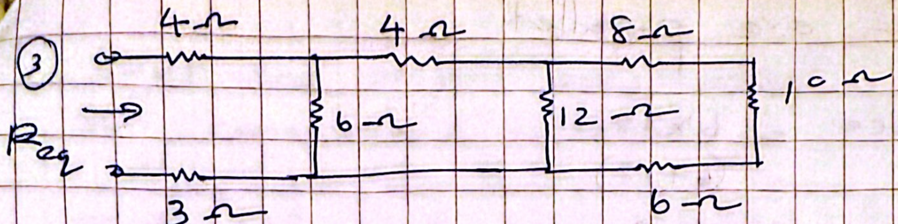
$$-70 + V_x + 2V_x - V_o = 0$$

$$3V_x - V_o = 70$$
$$3(10I) - (-5I) = 70$$
$$35I = 70$$
$$\boxed{I = 2A}$$

So $V_x = 10I$
$= 10(2)$
$V_x = 20V$

$V_o = 5I$
$= 5(2)$
$V_o = 10V$

(3)



~~8 Ω, 10 Ω, 6 Ω in series~~

If R_1 & R_2 series $R_{eq} = R_1 + R_2$

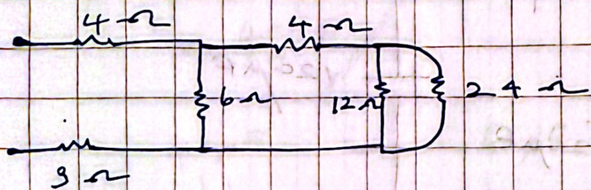
If R_1 & R_2 Parallel $\cancel{R_{eq}} = \frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}$

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

So 8 Ω, 10 Ω, 6 Ω in series

So Resistance $= 8 + 10 + 6$

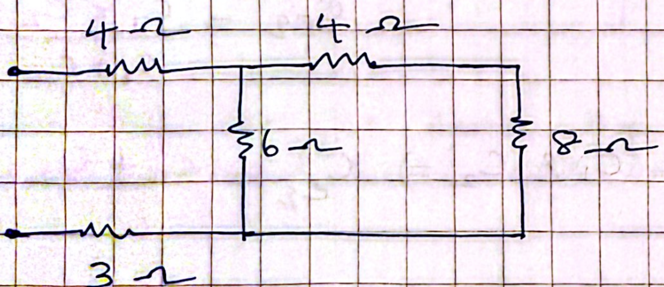
$= 24\ \Omega$



12 Ω & 24 Ω parallel

So Resistance $= \frac{24 \times 12}{(24 + 12)}$

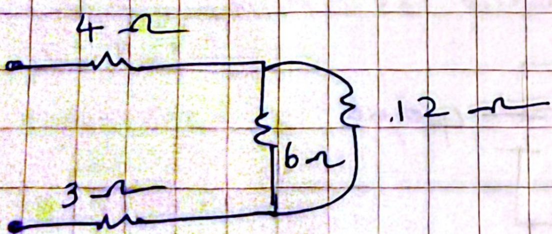
$= 8\ \Omega$



8 Ω & 4 Ω series

So Resistance $= 8\ \Omega + 4\ \Omega$

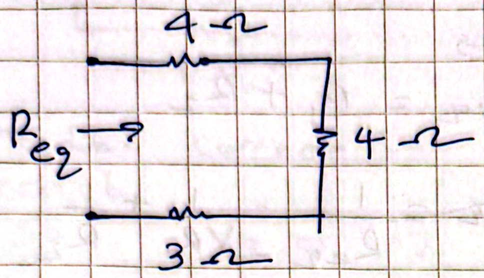
$= 12\ \Omega$



$6\,\Omega$ & $12\,\Omega$ are parallel

So Resistance $= \dfrac{6 \times 12}{(6+12)}$

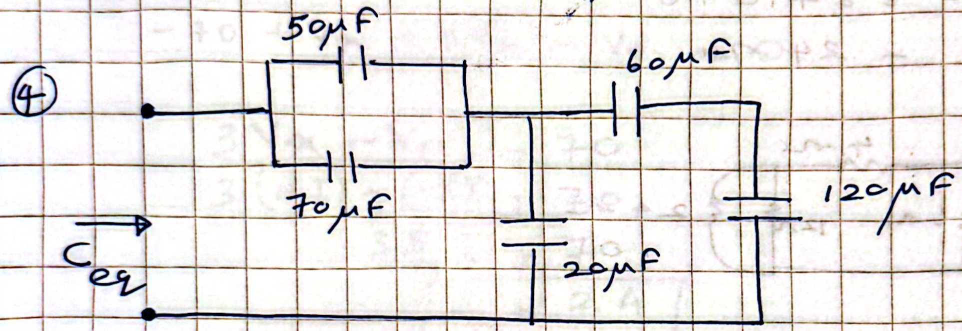
$= 4\,\Omega$



So $R_{eq} = 4\,\Omega + 4\,\Omega + 3\,\Omega$

$= 11\,\Omega$

(4)



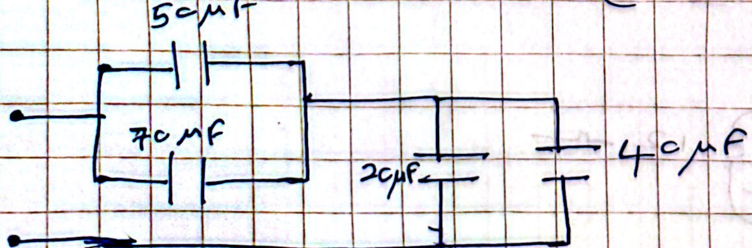
Series capacitors C_1 & $C_2 \Rightarrow \dfrac{1}{C_{eq}} = \dfrac{1}{C_1} + \dfrac{1}{C_2}$

$C_{eq} = \dfrac{C_1 \times C_2}{C_1 + C_2}$

Parallel capacitors C_1 & $C_2 \Rightarrow C_{eq} = C_1 + C_2$

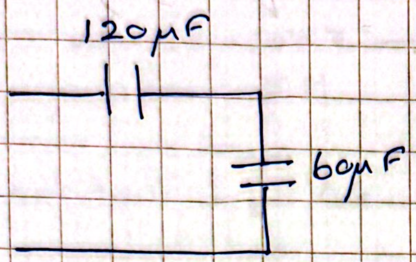
$60\,\mu F$ & $120\,\mu F$ in series

So capacitence $= \dfrac{60 \times 120}{(60+120)} = 40\,\mu F$



50μF and 70μF are parallel
so capacitence = 120μF

20μF and 40μF are parallel
so capacitence = 20 + 40
= 60μF

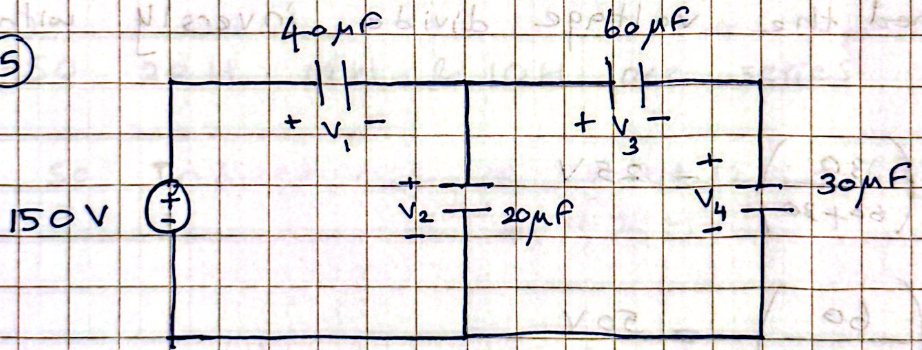


120μF and 60μF are series capacitors

so $C_{eq} = \frac{120 \times 60}{(120+60)}$

$= 40\mu F$

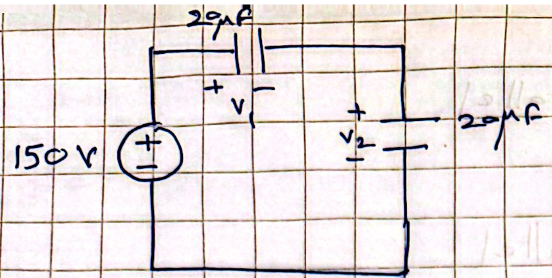
(5)



~~We~~ ~~can~~ This can be done by using voltage divider method. First need to simplify the circuit.

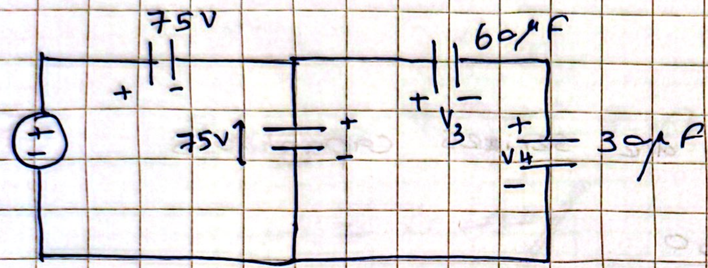
60μF and 30μF are series. (V3 & V4 capacitors)
So Capacitence $= \frac{60 \times 30}{90} = 20\mu F$

This 20μF capacitor and V2 voltage has 20μF capacitor. They are parallel.
So capacitence of them = 20μF + 20μF
= 40μF



150 ~~V~~ divide in both V_1 & V_2 equally, because they have same capacitence.

So $\boxed{V_1 = 75\,V}$ $\boxed{V_2 = 75\,V}$



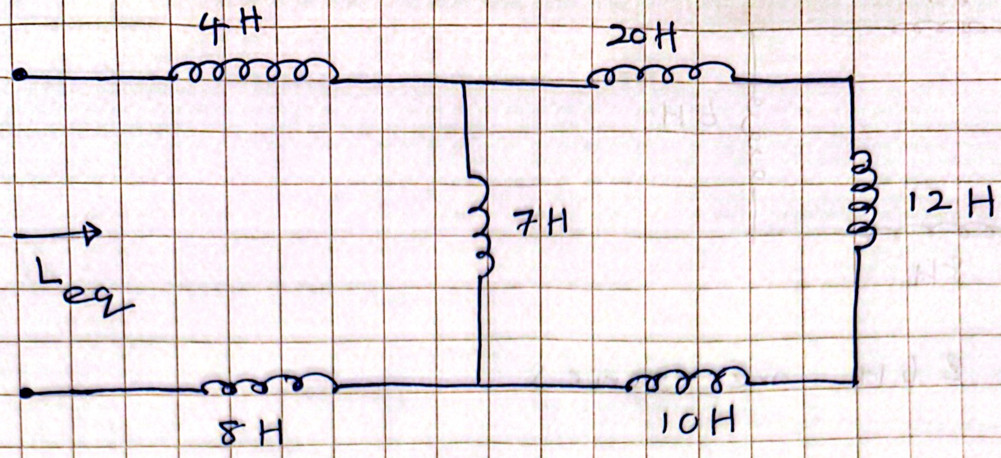
This 75 V in V_2 is divide between 60μF and 30μF. In capacitors smaller capacitence get more voltage.
So ~~this~~ ~~methed~~ the voltage divide inversly with Capacitence.

$$V_3 = 75 \cdot \left(\frac{30}{60+30}\right) = 25\,V$$

$$V_4 = 75 \cdot \left(\frac{60}{60+30}\right) = 50\,V$$

$V_1 = 75\,V$ // $V_2 = 75\,V$ // $V_3 = 25\,V$ // $V_4 = 50\,V$ //

(6)



If L_1 & L_2 are series inductors $\Rightarrow$

$$L_{eq} = L_1 + L_2$$

If L_1 and L_2 are parallel inductors $\Rightarrow$

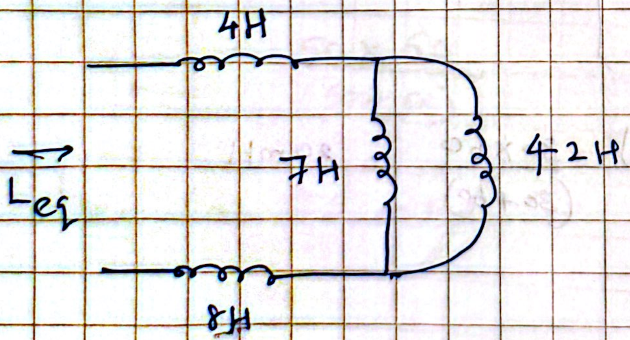
$$\frac{1}{L_{eq}} = \frac{1}{L_1} + \frac{1}{L_2}$$

$$L_{eq} = \frac{L_1 L_2}{L_1 + L_2}$$

So 20 H, 12 H & 10 H are series

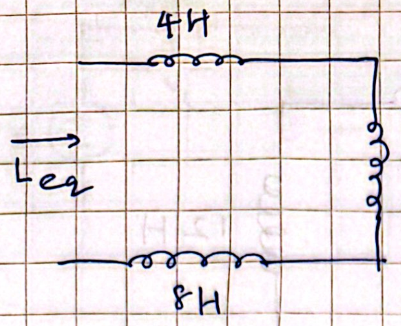
So Inductence = 20 H + 12 H + 10 H

= 42 H



7 H & 42 H are parallel

So inductence $= \frac{42 \times 7}{42 + 7} = 6\ H$

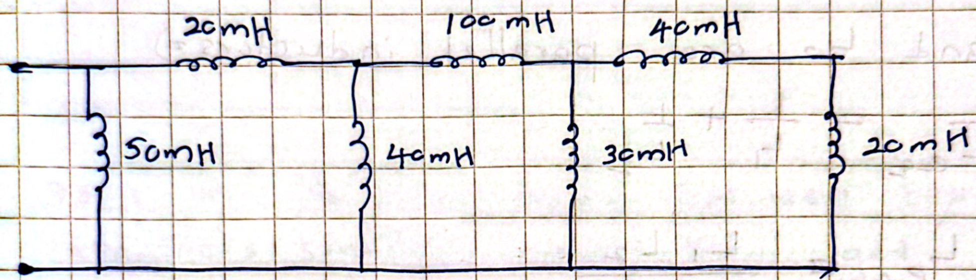


4H, 8H & 6H are series

So $L_{eq} = 4H + 6H + 8H$

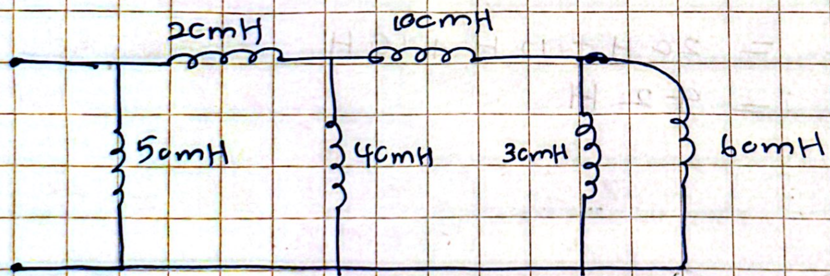
$L_{eq} = 18H$

7

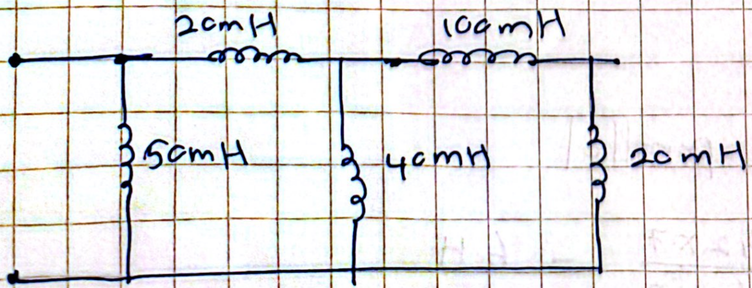


40 mH & 20 mH are series ⇒

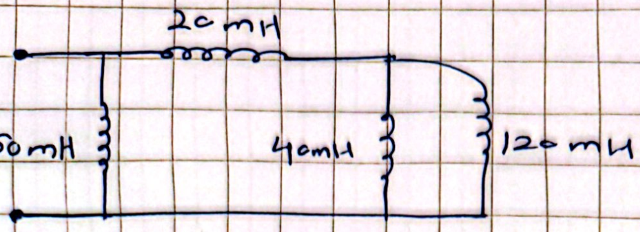
So inductence = 40 + 20 = 60 mH



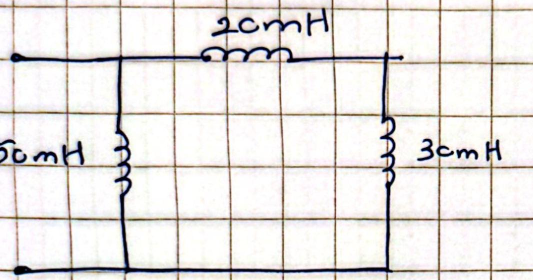
30mH & 60 mH parallel ⇒ $\frac{30 \times 60}{(30+60)} = 20mH$



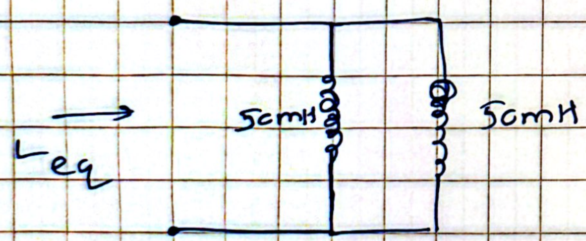
$100\,mH$ & $20\,mH$ series $\Rightarrow 100\,mH + 20\,mH$
$= 120\,mH$



$120\,mH$ & $40\,mH$ parallel $\Rightarrow \dfrac{40 \times 120}{(40+120)} = 30\,mH$



$20\,mH$ & $30\,mH$ series $\Rightarrow 30\,mH + 20\,mH = 50\,mH$



$50\,mH$ & $50\,mH$ parallel

$$L_{eq} = \frac{50 \times 50}{(50+50)}$$

$$L_{eq} = 25\,mH$$