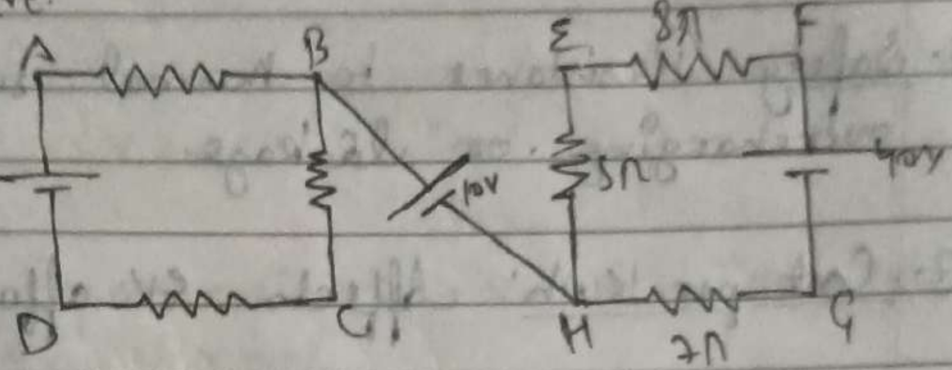
ASSIGNMENT - 2

Q1 Find the value of V_{CE} & V_{AG} in the given figure.



Sol. In loop EFGHE

$$I_A = \frac{40}{8+5+7} = \frac{40}{20} = 2A$$

$$V_F = 40V$$

⇒ Voltage accross $8\Omega = 16V$

$$V_E = 40 - 16 = 24V$$

⇒ Voltage accross $7\Omega = 14V$

$$V_H = 14 \cdot\cdot$$

Date :
Page No. :

In loop ABCDA

$$I_L = \frac{20}{6+5+9} = 1A$$

$$V_A = V_D + 20$$

$\Rightarrow$ Voltage accross $6\Omega = 6V$

$$V_B = V_A - 6 = V_D + 14$$

$\Rightarrow$ Voltage accross $9\Omega = 9V$

$$V_C = V_D + 9$$

In branch BH

$$V_B - V_H = 10$$

$$V_B - 14 = 10 \Rightarrow V_B = 24\ V$$

$$V_B = V_D + 14$$

$$24 = V_D + 14 \Rightarrow V_D = 10V$$

$$V_A = V_D + 20 \Rightarrow 30V$$

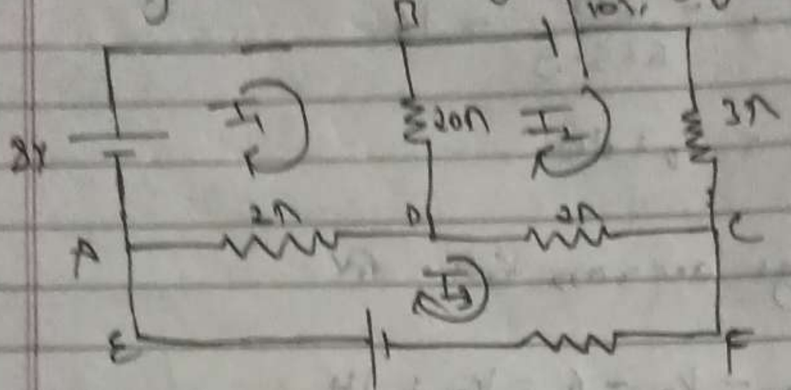
$$V_C = V_D + 9 = 19V$$

$$V_{CG} = V_C - V_G = 19 - 24 = -5V$$

$$V_{AG} = V_A - V_G = 30 - 0 = 30V$$

Date :
Page No. :

Q. Find the current in 5Ω resistance using Mesh analysis in fig.



In mesh ADBA

$$(I_1 - I_3)2 + (I_1 - I_2)20 = 8$$
$$I_1 - I_3 + (I_1 - I_2)10 = 4$$

$$11I_1 - 10I_2 - I_3 = 4 \quad \text{—(i)}$$

In mesh CDBC

$$I_2(3) + (I_2 - I_3)2 + (I_2 - I_1)20 = 10$$
$$3I_2 + 2I_2 - 2I_3 + 20I_2 - 20I_1 = 10$$

$$-20I_1 + 25I_2 - 2I_3 = 10 \quad \text{—(ii)}$$

In Mesh ACFEA

$$(I_3 - I_1)2 + (I_3 - I_2)2 + I_3(5) = 12$$

Date :
Page No. :

$2I_3 - 2I_1 + 2I_3 - 2I_2 + 5I_3 = 12$

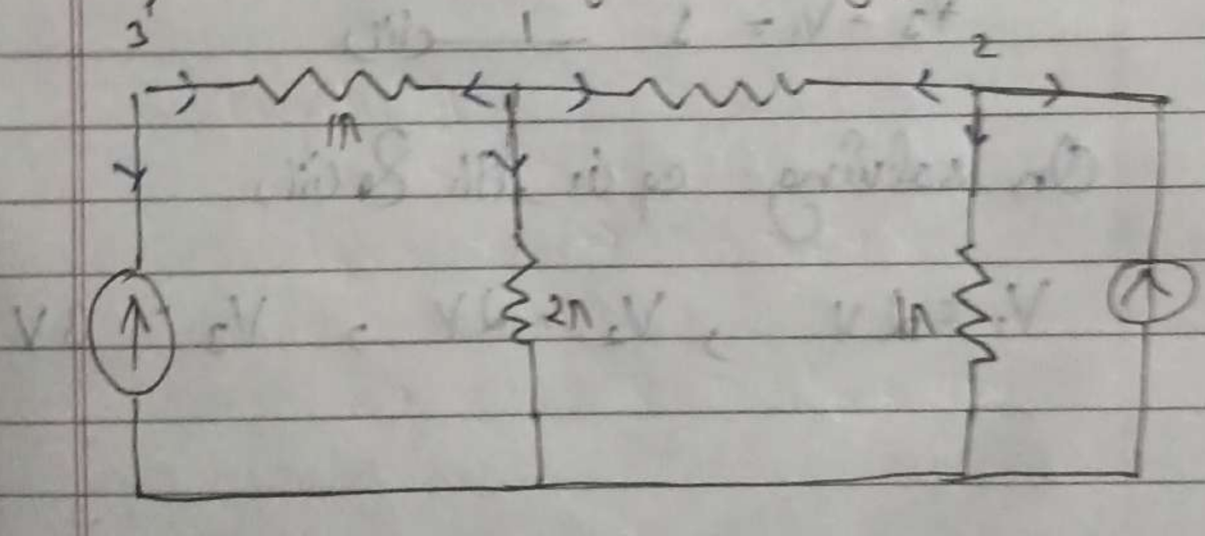
$-2I_1 - 2I_2 + 9I_3 = 12$ —— (iii)

On solving eq^n i, ii & iii

$I_1 = 4.68A$, $I_2 = 4.41A$, $I_3 = 3.635A$

I_3 passes through 5Ω resistor so current in 5Ω is 3.63A.

Q3. Find the voltage 1 & 2 with the help of nodal analysis in figure.



At node 1

$$\frac{V_1 - V_3}{1} + \frac{V_1}{2} + \frac{V_1 - V_2}{2} = 0$$

$$\frac{2V_1 - 2V_3 + V_1 + V_1 + V_2}{2} = 0$$

Date :
Page No. :

$$4V_1 - V_2 - 2V_3 = 0 \quad \text{--- (i)}$$

At node 2.

$$\frac{V_2 - V_1}{2} - \frac{V_2}{1} - 2 = 0$$

$$3V_2 - V_1 - 4 = 0$$

$$3V_2 - V_1 = 4 \quad \text{--- (ii)}$$

At node 3.

$$-1 + \frac{V_3 - V_1}{1} = 0$$

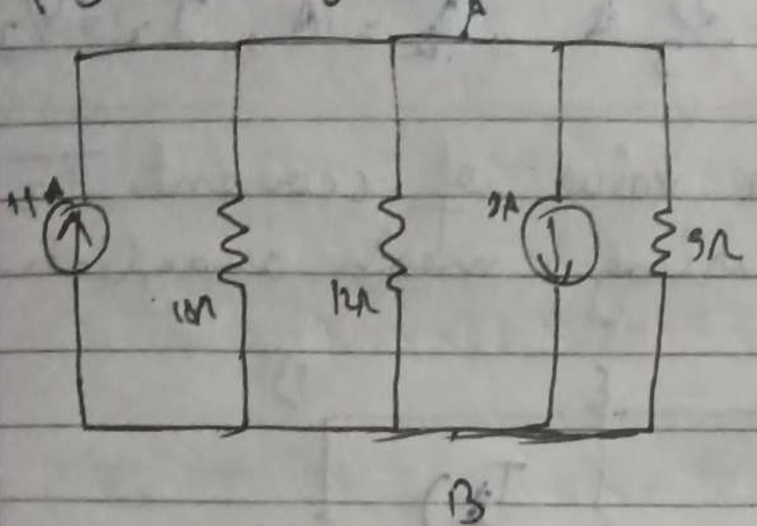
$$V_3 - V_1 = 1 \quad \text{--- (iii)}$$

On solving eq (i), (ii) & (iii)

$V_1 = 2V$, $V_2 = 2V$, $V_3 = 3V$

Date :
Page No. :

Q4. Find the value of currents shown in fig. using nodal analysis.



At node A.

$$-11 + \frac{V}{18} + \frac{V}{12} + 8 + \frac{V}{9} = 0$$

$$\frac{V}{3}\left(\frac{1}{6} + \frac{1}{4} + \frac{1}{3}\right) - 3 = 0$$

$$\frac{V}{3}\left(\frac{2+3+4}{12}\right) = 3$$

$$V\left(\frac{9}{12}\right) = 9$$

$$V = 12V$$

now $I_1 = \frac{V}{18} = \frac{12}{18} = 2/3$ A.

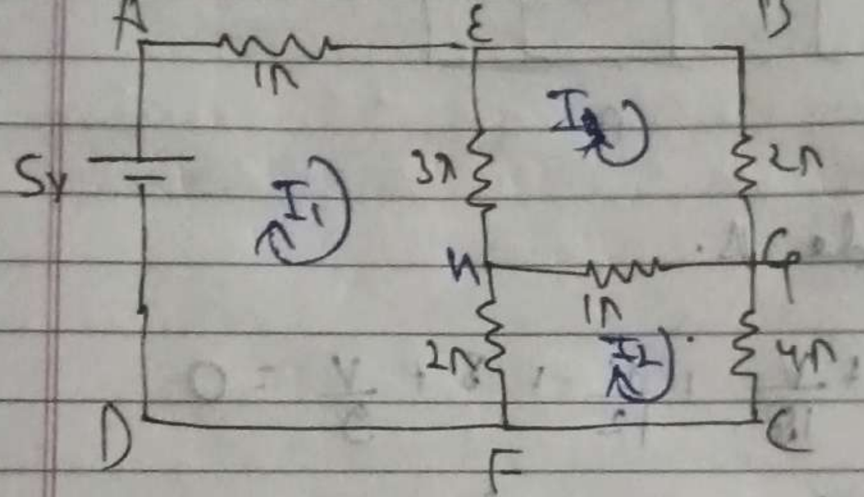
$I_2 = \frac{V}{12} = \frac{12}{12} = 1$ A

Date :
Page No. :

So $I_3 = \frac{V}{9} = \frac{12}{9} = \frac{4}{3}$ A

So $I_1 = 2/3$ A, $I_2 = 1$A, $I_3 = 4/3$ A

Q5. Find the value of current I_3 in figure using mesh analysis.



⇒ In loop AEFDA

$I_1(1) + (I_1 - I_3)3 + (I_1 - I_2)2 = 5.$

$I_1 + 3I_1 - 3I_3 + 5I_1 - 2I_2 = 5.$

$6I_1 - 2I_2 - 3I_3 = 5$ —— (i)

In loop EBGHE

$I_3(2) + (I_3 - I_2)1 + (I_3 - I_1) \times 3 = 0$

$2I_3 + I_3 - I_2 + 3I_3 - 3I_1 = 0$

$-3I_1 - I_2 + 6I_3 = 0$ —— (ii)

In loop HGCFGH

$(I_2 - I_3)1 + I_2(4) + (I_2 - I_1)2 = 0$

$I_2 - I_3 + 4I_2 + 2I_2 - 2I_1 = 0$

$-2I_1 + 7I_2 - I_3 = 0$ —— (iii)

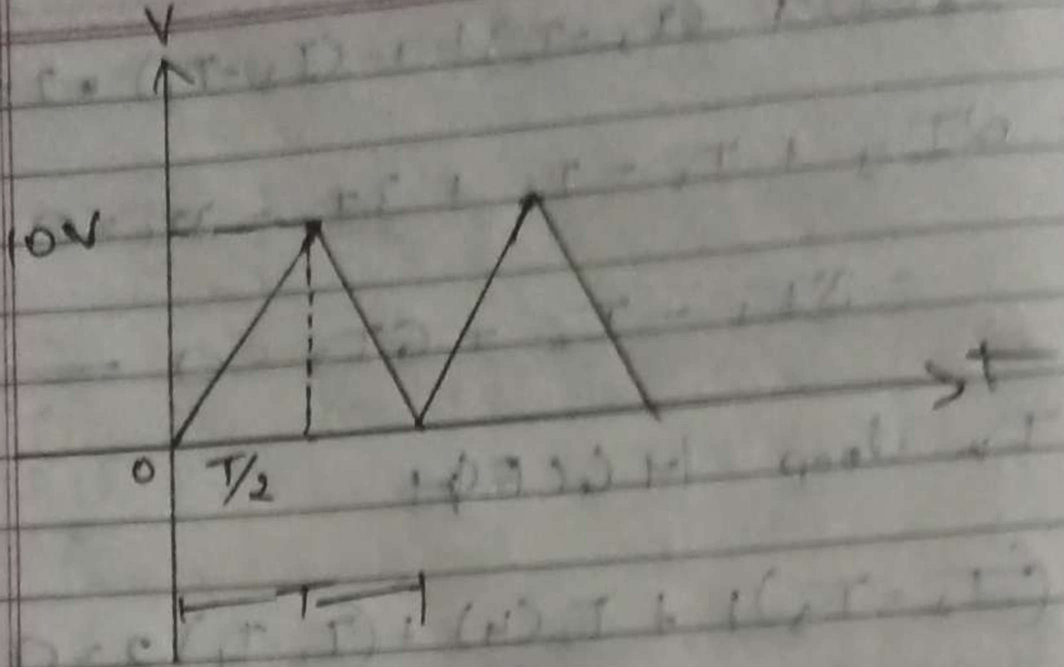
On solving (i), (ii), & (iii)

$I_1 = 1.35A$, $I_2 = 0.51A$, $I_3 = 0.823A$.

Q6. Find

i) The R.M.S Value

ii) form factor for a symmetrical triangular wave.



At $t=0$ $V=0$

$t = T/2$ $V = 10V$

$$V(t) = 20 - \frac{20t}{T}$$

$$V_{avg} = \frac{1}{T}\int_0^{T/2}\left(20 - \frac{20t}{T}\right)dt$$

$$= \frac{20}{T}\left(\int_0^{T/2} dt - \int_0^{T/2}\frac{t\,dt}{T}\right)$$

$$= \frac{20}{T}\left[t - \frac{t^2}{2T}\right]_0^{T/2}$$

$$= \frac{20}{T}\left[\frac{T}{2} - \frac{T^{\cancel{2}}}{4\cancel{T}}\right]$$

$$= \frac{1}{T}\cdot\frac{\cancel{20}}{\cancel{2}}\left[\frac{2T-T}{2}\right]$$

$$= 5[2-1]$$

$$= 5V$$

Date :
Page No. :

i) $V_{rms} = \sqrt{\frac{2}{T}\int_0^{T/2} v^2(t)\,dt}$

$= \sqrt{\frac{2}{T}\int_0^{T/2}\left(20 - \frac{20t}{T}\right)^2 dt}$

$= \sqrt{\frac{2}{T}\cdot 20^2 \int_0^{T/2}\left(1 - \frac{t}{T}\right)^2 dt}$

$= 20\sqrt{\frac{2}{T}\int_0^{T/2}\left(1 + \frac{t^2}{T^2} - \frac{2t}{T}\right) dt}$

$= 20\sqrt{\frac{2}{T}\left[t + \frac{t^3}{3\cdot T^2} - \frac{2t^2}{2T}\right]_0^{T/2}}$

$= 20\sqrt{\frac{2}{T}\left[\frac{T}{2} + \frac{T^3}{8\cdot 3\cdot T^2} - \frac{T^2}{4\cdot T}\right]}$

$= 20\sqrt{\frac{T\cdot 2}{T}\left(\frac{1}{2} + \frac{1}{24} - \frac{1}{4}\right)}$

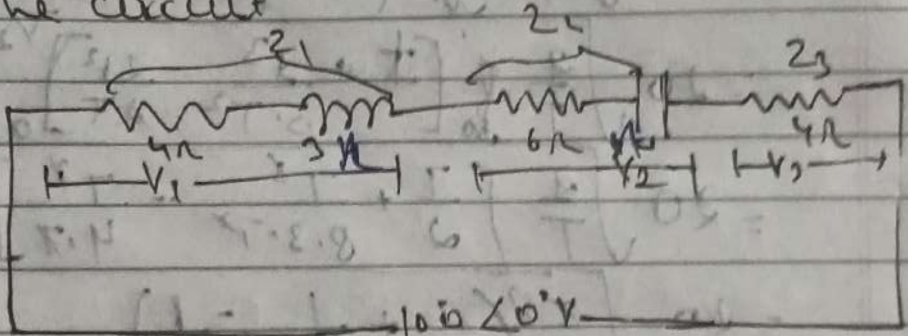
$= 20\sqrt{2\left(\frac{12+1-6}{24_{12}}\right)}$

$= \frac{20\sqrt{7}}{2\sqrt{3}} = 10\sqrt{\frac{7}{3}} = 15\cdot 27$

ii) $F\cdot F = \frac{V_{rms}}{V_{avg}} = \frac{15\cdot 27}{5} = 3\cdot 054$ V

Date :
Page No. :

Q7 In the circuit shown in fig
Calculate
i) Current
ii) Voltage drops V_1, V_2, V_3
iii) Power absorbed by each impedance & total power absorbed by the circuit



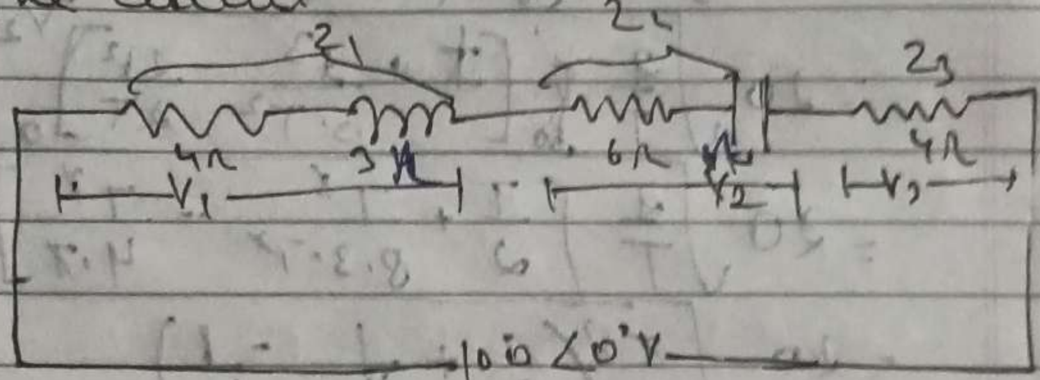
i) $Z_1 = (4 + i3)$
$Z_2 = (6 - i8)$
$Z_3 = 4$

$Z_T = 14 - 5i = 14.86 \angle -19.65$

i) $I = \frac{V}{Z_T} = \frac{100\angle 0}{14.86\angle -19.65} = 6.33 + 2.26i$

Date :
Page No. :

Q7 In the circuit shown in fig. Calculate
i) Current.
ii) Voltage drops V_1, V_2, V_3
iii) Power absorbed by each impedance & total power absorbed by the circuit



i) $Z_1 = (4 + i3)$

$Z_2 = (6 - i8)$

$Z_3 = 4$

$Z_T = 14 - 5i = 14.86\angle -19.65$

i) $I = \frac{V}{Z_T} = \frac{100\angle 0}{14.86\angle -19.65} = 6.33 + 2.26i$

ii) $V_1 = I Z_1 = (6.33 + j2.26)(4 + j3)$
$= 18.54 + j28.03$
$= 33.65 \angle 56.49 V$

$V_2 = I Z_2 = (6.33 + j2.26)(6 - j8)$
$= 19.9 - j64.2$
$= 67.3 \angle -33.81° V$

$V_3 = I Z_3 = (6.33 + j2.26) \cdot 4 = 25.32 + j9.0$
$= 26.92 \angle 19.62° V$

iii) $P_1 = |I|^2 R_1 = 180.706 W$

$P_2 = |I|^2 \cdot R_2 = (45.1765) * 6 = 271.059 W$

$P_3 = |I|^2 R_3 = 180.706 W$.

$P_T = (P_1 + P_2 + P_3) = 180.706 + 271.059 + 180.70$
$= 632.471 W$