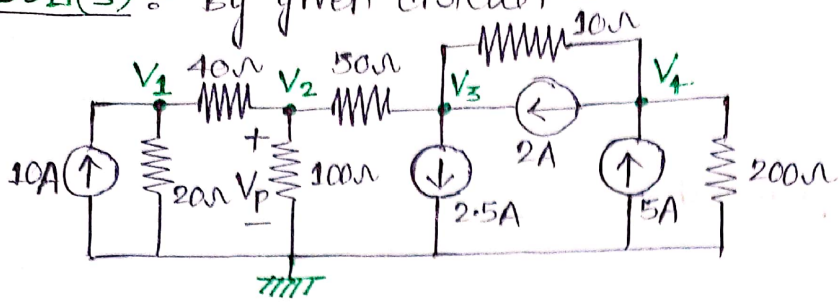
SOL(3) :- By given circuit —



By using nodal analysis, we get —

$$\frac{V_1}{20} + \frac{V_1 - V_2}{40} = 10$$

$$2V_1 + V_1 - V_2 = 400 \quad \text{—— (1)} \quad / \quad 3V_1 - V_2 = 400 \quad \text{—— (1)}$$

$$\frac{V_2 - V_1}{40} + \frac{V_2}{100} + \frac{V_2 - V_3}{50} = 0$$

$$5V_2 - 5V_1 + 2V_2 + 4V_2 - 4V_3 = 0$$

$$-5V_1 + 11V_2 - 4V_3 = 0 \quad \text{—— (2)}$$

$$\frac{V_3 - V_2}{50} + \frac{V_3 - V_4}{10} + 2.5 = 2$$

$$V_3 - V_2 + 5V_3 - 5V_4 + 125 = 100$$

$$-V_2 + 6V_3 - 5V_4 = -25 \quad \text{—— (3)}$$

$$\frac{V_4 - V_3}{10} + \frac{V_4}{200} + 2A = 5$$

$$20V_4 - 20V_3 + V_4 + 400 = 1000$$

$$-20V_3 + 21V_4 = 600 \quad \text{—— (4)}$$

$$V_p = V_2 \quad \text{—— (5)}$$

After solving, we get —

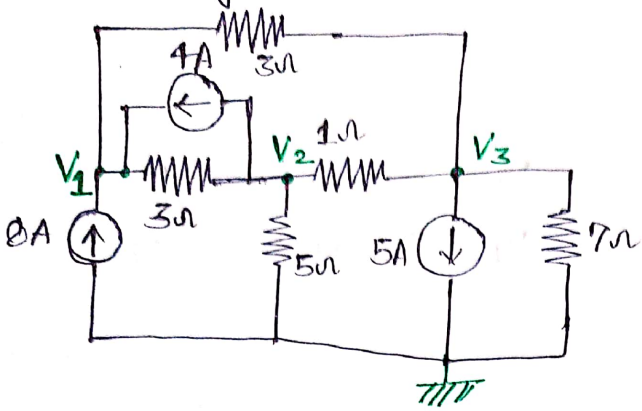
$\therefore V_1 = 190.55$ Volt

$\therefore V_p = V_2 = 171.64$ Volt

$\therefore V_3 = 233.82$ Volt

$\therefore V_4 = 251.26$ Volt

SOL(4) :- By given circuit, we get —



By using nodal analysis —

$$\frac{V_1-V_2}{3}+\frac{V_1-V_3}{3}=8+4$$

$$2V_1-V_2-V_3=36 \quad \text{——— (1)}$$

$$\frac{V_2-V_1}{3}+\frac{V_2}{5}+\frac{V_2-V_3}{1}+4=0$$

$$5V_2-5V_1+3V_2+15V_2-15V_3+60=0$$

$$-5V_1+23V_2-15V_3=-60 \quad \text{——— (2)}$$

$$\frac{V_3-V_2}{1}+\frac{V_3-V_1}{3}+\frac{V_3}{7}+5=0$$

$$21V_3-21V_2+7V_3-7V_1+3V_3+105=0$$

$$-7V_1-21V_2+31V_3=-105 \quad \text{——— (3)}$$

By eqn (1), (2) & (3), we get —

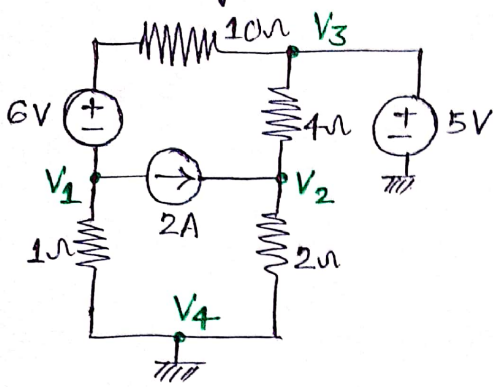
$\therefore V_1 = 26.73$ Volt

$\therefore V_2 = 8.83$ Volt

$\therefore V_3 = 8.63$ Volt

$\therefore$ Current through 7Ω resistance $= \frac{V_3}{7} = \frac{8.63}{7} = 1.23A$

SOL(5) :- By given circuit —



$V_3 = 5$ Volt —— (1)

$V_4 = 0$ volt —— (2)

By nodal analysis, we get —

$$\frac{V_1}{1} + 2 + \frac{V_1 + 6 - 5}{10} = 0$$

$$10V_1 + 20 + V_1 + 1 = 0$$

$$11V_1 = -21$$

$$\therefore V_1 = (-21/11) \text{ Volt} \quad \text{——} \quad (3)$$

$$\frac{V_2}{2} + \frac{V_2 - V_3}{4} = 2$$

$$2V_2 + V_2 - V_3 = 8$$

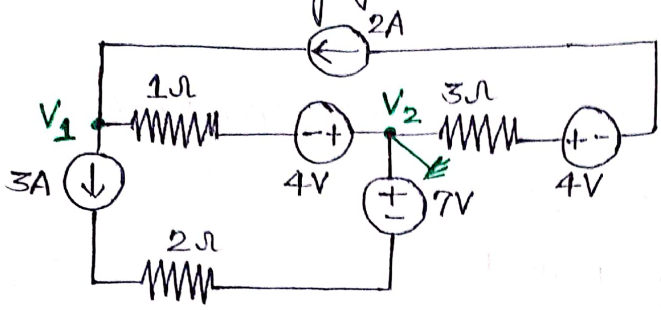
$$3V_2 - V_3 = 8$$

$$3V_2 = 8 + V_3 = 13$$

$$\therefore V_2 = (13/3) \text{ Volt} \quad \text{——} \quad (4)$$

SOL(6):-

By given circuit —



Taking V_2 as reference node, hence — $\therefore V_2 = 0$ Volt —— (1)

Nodal analysis at node ①, we get —

$$\frac{V_1 + 4}{1} + 3 = 2$$

$\therefore V_1 = -5$ Volt —— (2)

$\therefore$ Current through 1Ω resistance $= \left(\frac{V_1+4}{1}\right) = (-5+4)$

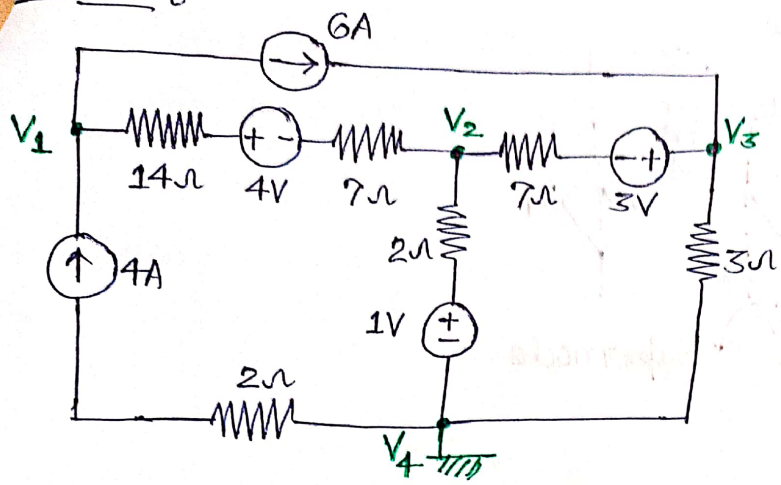
$= (-1\,A)$

$\therefore$ Power dissipation in 1Ω resistance $= I^2 \times R$

$= (1)^2 \times 1$

$= 1$ Watt

SOL (7) :-



Apply nodal analysis —

$$\frac{-V_2+V_1-4}{21}+6=4$$

$$-V_2+V_1-4+126=84$$

$$V_1-V_2=-38 \text{ Volt} \quad \text{—— (1)}$$

$$\frac{V_2+4-V_1}{21}+\frac{V_2-1}{2}+\frac{V_2+3-V_3}{7}=0$$

$$2V_2+8-2V_1+21V_2-21+6V_2+18-6V_3=0$$

$$-2V_1+29V_2-6V_3=(-5) \quad \text{—— (2)}$$

$$\frac{V_3-3-V_2}{7}+\frac{V_3}{3}=6$$

$$3V_3-9-3V_2+7V_3=126$$

$$-3V_2+10V_3=135 \quad \text{—— (3)}$$

By solving eqn (1), (2) & eqn (3), we get —

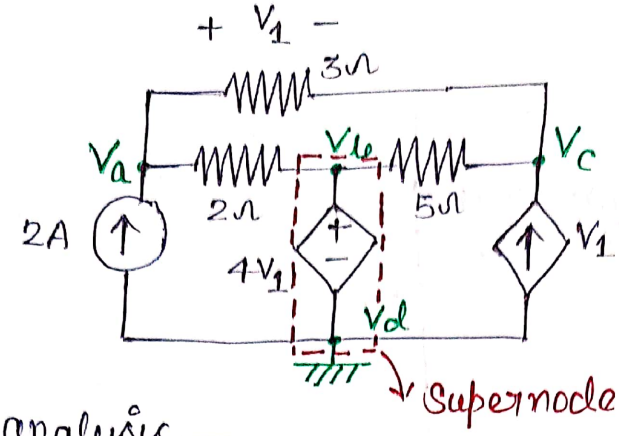
$\therefore V_1 = -38.00$ Volt

$\therefore V_2 = +0.00$ Volt

$\therefore V_3 = 13.50$ Volt

$\therefore V_4 = 0$ Volt

Sol (8) :-



Apply nodal analysis —

$$\frac{V_a - V_b}{2} + \frac{V_a - V_c}{3} = 2$$

$$3V_a - 3V_b + 2V_a - 2V_c = 12$$

$$5V_a - 3V_b - 2V_c = 12 \quad \text{——— (1)}$$

~~$\frac{V_b - V_a}{2} + \frac{V_c - V_c}{5}$~~

$$V_b - V_d = 4V_1 \quad \text{——— (2)} \quad , \quad V_b = 4V_1 \quad \text{——— (3)}$$

$$\frac{V_c - V_b}{5} + \frac{V_c - V_a}{3} = V_1$$

$$-5V_a - 3V_b + 8V_c = 15V_1 \quad \text{——— (4)}$$

By eqn (1), (2), (3) & (4), we get —

$\therefore V_a = 2.97$ Volt

$\therefore V_b = -1.23$ Volt

$\therefore V_c = 3.28$ Volt

$\therefore V_1 = -0.31$ Volt