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CSE250 Sec: 05

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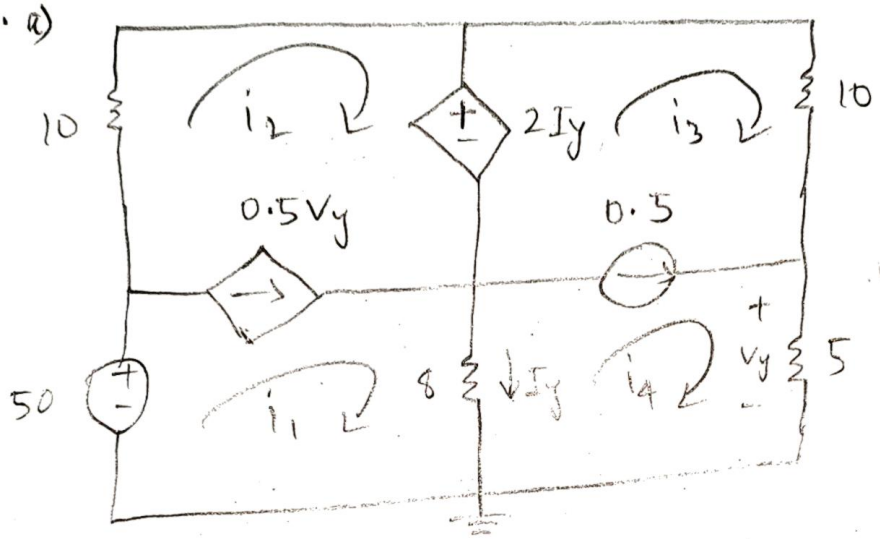
Spring 24 A

3. a)



$i_4 - i_3 = 0.5$, $I_y = i_1 - i_4$, $v_y = 5 i_4$, $i_1 - i_2 = 0.5 v_y$

$\Rightarrow i_1 - i_2 - 2.5 i_4 = 0$

—— (1) —— (II)

Supermesh 1,2.

$-50 + 10 i_2 + 2 I_y + 8 (i_1 - i_4) = 0$

$\Rightarrow 10 i_2 + 2 i_1 - 2 i_4 + 8 i_1 - 8 i_4 = 50$

$\Rightarrow 10 i_1 + 10 i_2 - 10 i_4 = 50$

$\Rightarrow i_1 + i_2 - i_4 = 5$ —— (III)

Supermesh 3,4

$-2 I_y + 10 i_3 + 5 i_4 + 8 (i_4 - i_1) = 0$

$\Rightarrow -2 i_1 + 2 i_4 + 10 i_3 + 5 i_4 + 8 i_4 - 8 i_1 = 0$

$\Rightarrow -10 i_1 + 10 i_3 + 15 i_4 = 0$

$\Rightarrow -2 i_1 + 2 i_3 + 3 i_4 = 0$ —— (IV)

①, ②, ③, ④ ⇒

$i_1 = -9.5\ A$

$i_2 = -0.5\ A$

$i_3 = 3.5\ A$

$i_4 = 4\ A$

b) $i_{2iy} + 0.5 + i_y = 0.5\ V_y$

$\Rightarrow i_{2iy} = 0.5 \times 5 \times i_4 - 0.5 - (-i_4 + i_1)$

$= 0.5 \times 5 \times 4 - 0.5 - (-4 + 9.5)$

$= 4\ A$

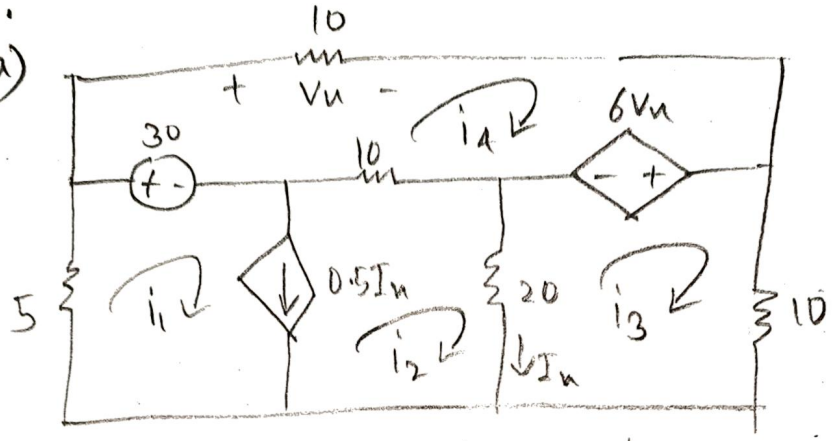
$\therefore$ Power $= -VI$

$= -2(i_1 - i_4)4$

$= -44\ W$

4.

a)



$I_n = i_2 - i_3$, $0.5 I_n = i_1 - i_2$

$\Rightarrow i_2 - i_3 = 2i_1 - 2i_2$

$V_n = 10 i_4$

$\Rightarrow 2i_1 - 3i_2 + i_3 = 0$ —— (I)

mesh4

$10 i_4 + 6 V_n + 10(i_4 - i_2) - 30 = 0$

$\Rightarrow -10 i_2 + 20 i_4 + 60 i_4 = 30$

$\Rightarrow -i_2 + 8 i_4 = 3$ —— (II)

mesh 3

$-6 V_n + 10 i_3 + 20 (i_3 - i_2) = 0$

$\Rightarrow -60 i_4 + 10 i_3 + 20 i_3 - 20 i_2 = 0$

$\Rightarrow -2 i_2 + 3 i_3 - 6 i_4 = 0$ —— (III)

Supermesh 1,2

$$5i_1 + 30 + 10(i_2 - i_4) + 20(i_2 - i_3) = 0$$

$$\Rightarrow 5i_1 + 30i_2 - 20i_3 - 10i_4 = -30$$

$$\Rightarrow i_1 + 6i_2 - 4i_3 - 2i_4 = -6 \quad \text{(IV)}$$

(I), (II), (III), (IV) $\Rightarrow$

$i_1 = -1$ A

$i_2 = -0.6$ A

$i_3 = 0.2$ A

$i_4 = 0.3$ A

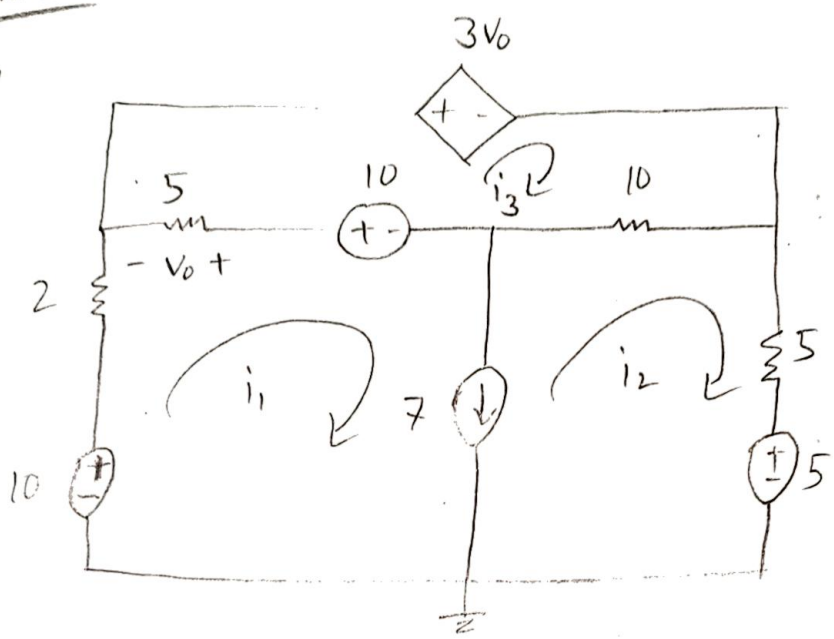
b) mesh1

$$5i_1 + 30 + V = 0$$

$$\Rightarrow V = -25\,V$$

Fall23

2.



$i_1 - i_2 = 7$ ——(i) , $V_0 = 5(i_3 - i_1)$

mesh 3

$3V_0 + 10(i_3 - i_2) - 10 + 5(i_3 - i_1) = 0$

$\Rightarrow 15i_3 - 15i_1 + 10i_3 - 10i_2 + 5i_3 - 5i_1 = 10$

$\Rightarrow -20i_1 - 10i_2 + 30i_3 = 10$

$\Rightarrow -2i_1 - i_2 + 3i_3 = 1$ ——(ii)

Supermesh 1,2

$-10 + 2i_1 + 5(i_1 - i_3) + 10 + 10(i_2 - i_3) + 5i_2 + 5 = 0$

$\Rightarrow 7i_1 + 15i_2 - 15i_3 = -5$ ——(iii)

(I), (II), (III) =>

$i_1 = 10\,mA$

$i_2 = 3\,mA$

$i_3 = 8\,mA$

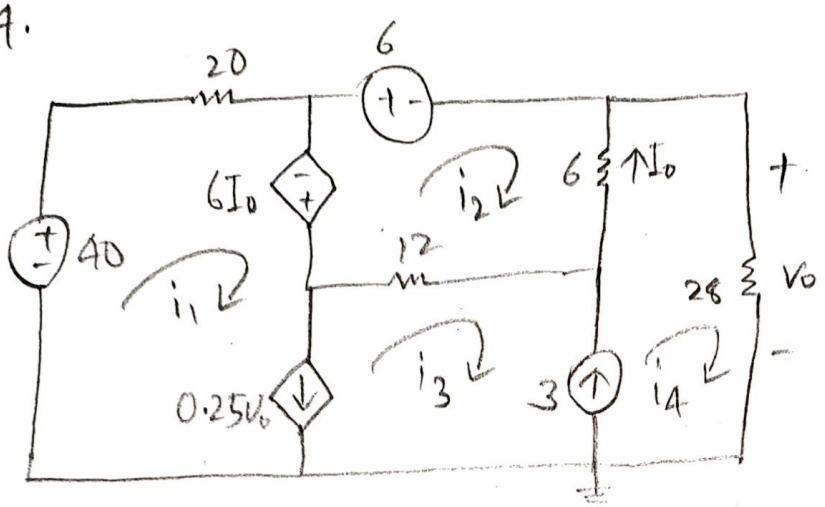
$\therefore$ power $= 3.5(i_3 - i_1) \times i_3$

$= 15\,(8-10) \times 8 \times 10^{-3}$

$= -30 \times 8 \times 10^{-3}$

$= -0.24\ W$ Ans.

4.



$i_4 - i_3 = 3$, $I_0 = i_4 - i_2$, $0.25V_0 = i_1 - i_3$

——(i)

$\Rightarrow 7i_4 = i_1 - i_3$

$\Rightarrow i_1 - i_3 - 7i_4 = 0$ ——(ii)

mesh 2

$6I_0 + 6 + 6(i_2 - i_4) + 12(i_2 - i_3) = 0$

$\Rightarrow 6(i_4 - i_2) + 6(i_4 - i_2) + 12i_2 - 12i_3 = -6$

$\Rightarrow 2i_2 - 2i_3 = -1$ ——(iii)

Supermesh 1, 3, 4

$-40 + 20i_1 - 6I_0 + 12(i_3 - i_2) + 6(i_4 - i_2) + 28i_4 = 0$

$\Rightarrow 20i_1 - 6i_4 + 6i_2 + 12i_3 - 12i_2 + 6i_4 - 6i_2 + 28i_4 = 40$

$\Rightarrow 20i_1 - 12i_2 + 12i_3 + 28i_4 = 40$ ——(iv)

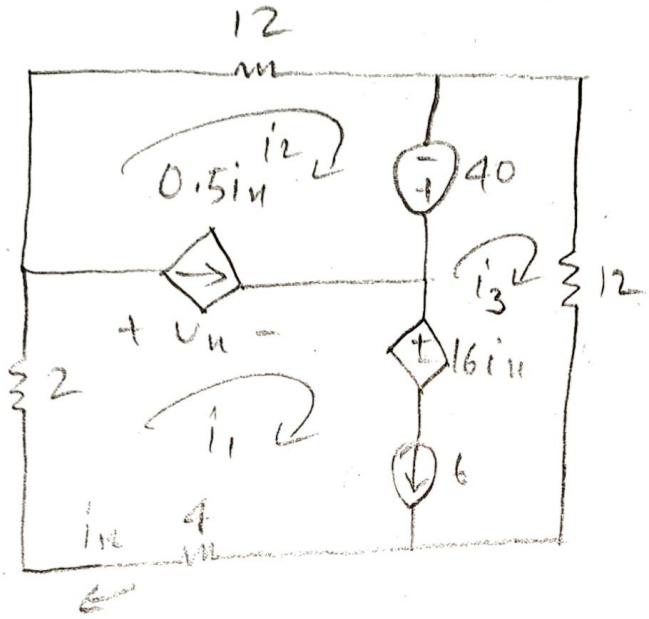
$\therefore i_1 = 1 \;,\; i_2 = -3 \;,\; i_3 = -2.5 \;,\; i_4 = 0.5$

b) $V_o = 28 \times 0.5 = 14\,V$

$I_o = 0.5 + 3 = 3.5\,A$

Summer 23

2. a)



$i_u = i_1$, $i_1 - i_3 = 6$ —— (I)

$i_1 - i_2 = 0.5 i_u$

$\Rightarrow i_1 - 2i_2 = 0$ —— (II)

Supermesh 1,2,3

$2i_1 + 12i_2 + 12i_3 + 4i_u = 0$

$\Rightarrow i_1 + 2i_2 + 2i_3 = 0$ —— (III)

(I), (II), (III) $\Rightarrow$

$i_1 = 3\ A$ $\quad i_2 = 1.5\ A$ $\quad i_3 = -3\ A$

b)

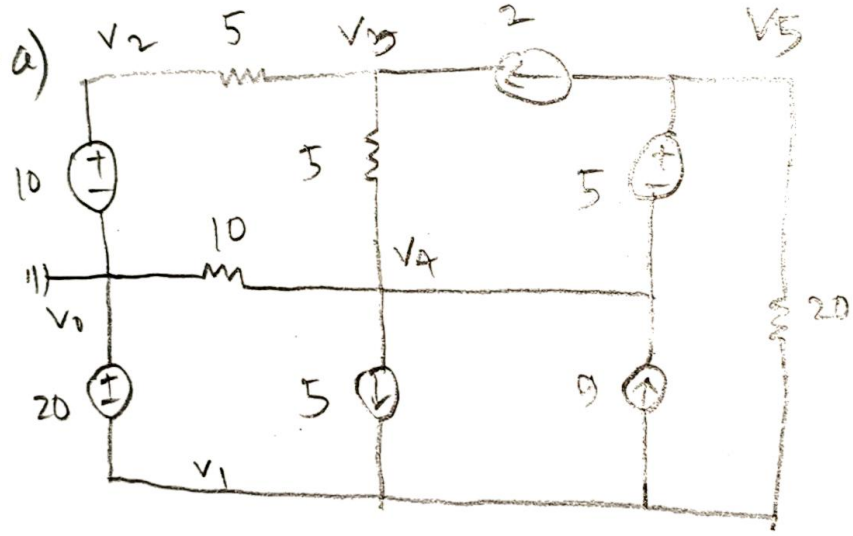
mesh2

$12i_2 - 40 - V_n = 0$

$\Rightarrow V_n = -22$ ✓

there is no 2in dependent current source,

3.a)



$V_2 = 10$, $V_1 = -20$, $V_5 - V_4 = 5$ ——— (1)

node3

$V_3\left(\frac{1}{5} + \frac{1}{5}\right) - 2 - V_2\frac{1}{5} - V_4\frac{1}{5} = 0$

$\Rightarrow \frac{2}{5}V_3 - \frac{1}{5}V_4 = 4$

$\Rightarrow 2V_3 - V_4 = 20$ ——— (11)

supernode 4,5

$$V_4\left(\frac{1}{10}+\frac{1}{5}\right)+V_5\left(\frac{1}{20}\right)+2+5-9-V_3\frac{1}{5}-V_1\frac{1}{20}=0$$

$$\Rightarrow -\frac{1}{5}V_3+\frac{3}{10}V_4+\frac{1}{20}V_5=1 \quad \text{— (III)}$$

(I), (II), (III) $\Rightarrow$

$V_3 = 15.5\ V$

$V_4 = 11\ V$

$V_5 = 16\ V$

b). $I_{20\Omega} = \frac{V_5 - V_1}{20} = \frac{16+20}{20} = 1.8\ mA$

$\therefore\ 2 + 1.8 + I_{5V} = 0$

$\Rightarrow I_{5V} = -3.8\ mA$

$\therefore P_{5V} = 5\,(-3.8\times10^{-3})$

$= -19\ mW$