ASSIGNMENT 01 [MID-TERM]

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The variables value according to ID:

m_1	m_2	m_3	m_4	m_5
4	4	7	9	3

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Problem-1:

a. Here,

$m_5 = 3.$

$R_1 = 5.2 + (2 \times 3)$

$= 11.2\ K\Omega.$

We know,

$$R_A = \left(\frac{1}{R_6} + \frac{1}{R_7}\right)^{-1} + R_8 + R_9$$

$$= \left(\frac{1}{9} + \frac{1}{6}\right)^{-1} + 3.3 + 5.1$$

$$= 12\ K\Omega.$$

$$R_B = \left(\frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4 + R_5}\right)^{-1}$$

$$= \left(\frac{1}{16} + \frac{1}{32} + \frac{1}{20+12}\right)^{-1} K\Omega$$

$$= 8\ K\Omega.$$

$$R_C = \left(\frac{1}{R_A} + \frac{1}{R_B}\right)^{-1}$$

$$= \left(\frac{1}{12} + \frac{1}{8}\right)^{-1} K\Omega$$

$$= 4.8\,K\Omega$$

$$R_T = R_1 + R_B$$

$$= (11.2 + 4.8)\,K\Omega$$

$$= 16\,K\Omega$$

$$I_S = \frac{V}{R_T} = \frac{280}{16} = 17.5\,mA.$$

$$I_1 = \frac{R_C}{R_B} \times I_S$$

$$= \frac{4.8}{8} \times 17.5$$

$$= 10.5\,mA$$

$$I_2 = \frac{R_B}{R_2} \times I_1$$

$$= \frac{8}{16} \times 10.5$$

$$= 5.25\,mA.$$

$I_5 = I_5 - I_1 = (27.5 - 22) = 5.5\,mA.$ 3

$I_6 = \frac{R_p}{R_6} \times I_5$

$= \frac{3.6}{9} \times 5.5.$

$= 2.2\,mA.$

$\frac{1}{R_p} = \left(\frac{1}{R_6} + \frac{1}{R_7}\right)^{-1}$

$= \left(\frac{1}{9} + \frac{1}{6}\right)^{-1}$

$= 3.6\,mA.$

$I_8 = I_5 = 5.5\,mA.$

b. Here,

$V_2 = I_2 R_2$

$= (5.25 \times 16)V$

$= 84V$

$V_7 = (I_5 - I_6) \times R_7$

$= (5.5 - 2.2) \times 6$

$= 19.8\,V$

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$V_8 = I_8 R_8$

$= (5.5 * 3.3) V$

$= 18.15 V$

$V_9 = I_9 R_9 \quad [I_8 = I_9]$

$= (5.5 \times 5.1) V$

$= 28.05 V.$

C.

$P_{R_2} = I_2^2 R_2$

$= (5.25)^2 \times 16$

$= 441 kW.$

$R_2 = 16 k\Omega$

$R_6 = 9 k\Omega$

$R_9 = 5.1 k\Omega$

$P_{R_6} = I_6^2 R_6$

$= (2.2)^2 \times 9$

$= 43.56 kW.$

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$P_{R_g} = I_g^2 R_g \quad [I_g = I_g]$

$= (5.5)^2 \times 5.1.$

$= 154.28 \text{ KW.}$

Problem-2

$m_4 = 9$

$R_1 = 2(1+9) = 20\,\Omega$

$R_2 = R_4 = 3(1+9) = 30\,\Omega$

$R_3 = 5(1+9) = 50\,\Omega$

a.

Loop equation-1:-

$(R_1+R_2+R_3)I_1 - R_3 I_2 = 35$

$\Rightarrow (20+30+50)I_1 - 30 I_2 = 35$

$\therefore 100 I_1 - 30 I_2 = 35 \quad (1)$

c

$$(R_3+R_4)I_2 - R_3 I_1 = -74$$

$$\Rightarrow (50+30)I_2 - 50 I_1 = -74$$

$$\therefore 80I_2 - 50 I_1 = -74 \quad \text{—— (2)}$$

b.

$$100I_1 - 30I_2 = 35 \quad \text{—— (1)}$$

$$80I_2 - 50I_1 = -74 \quad \text{— (2)}$$

$\therefore$ (2) $\times$ 2

$$-100I_1 + 160I_2 = -148$$

$$100I_1 - 30I_2 = 35$$

$$130I_2 = -113$$

$$\therefore I_2 = \frac{-113}{130} = -0.87\,A$$

$$\therefore 100I_1 - 30I_2 = 35$$

$$\Rightarrow 100I_1 - (30 \times -0.87) = 35$$

$$\Rightarrow 100I_1 = 35 + 26.1$$

$$\Rightarrow I_1 = \frac{61.1}{100}$$

$$\therefore I_1 = 0.611\,A.$$

$$I_3 = I_1 - I_2 = (-0.87 - 0.611)\,A$$

$$= -1.481\,A$$

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Problem-3

$m_5 = 3$

$R_1 = 4(1+3) = 16\ \Omega$

$R_2 = R_4 = 8(1+3) = 32\ \Omega$

$R_3 = 16(1+3) = 64\ \Omega$

a. For node V_1,

$$\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right)V_1 - \left(\frac{1}{R_3}\right)V_2 = -5A$$

$$\Rightarrow \left(\frac{1}{16} + \frac{1}{32} + \frac{1}{64}\right)V_1 - \left(\frac{1}{64}\right)V_2 = -5A$$

$$\Rightarrow \left(\frac{7}{64}\right)V_1 - \left(\frac{1}{64}\right)V_2 = -5A$$

$$\Rightarrow 7V_1 - V_2 = -320A$$

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For node V_2

$$\left(\frac{1}{R_3}+\frac{1}{R_2}\right)V_2-\left(\frac{1}{R_3}\right)V_1=-4A$$

$$\Rightarrow \left(\frac{1}{64}+\frac{1}{32}\right)V_2-\left(\frac{1}{64}\right)V_1=-4A$$

$$\Rightarrow \frac{3V_2}{64}-\frac{V_1}{64}=-4A$$

$$\Rightarrow 3V_2-V_1=-256A.$$

b.

$$7V_1-V_2=-320A.$$

$$3V_2-V_1=-256A.$$

$$D=\begin{vmatrix}7 & -1\\ -1 & 3\end{vmatrix}=21-1=20$$

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$$D_2 = \begin{vmatrix} -320 & -1 \\ -256 & 3 \end{vmatrix} = -960 - 256 = -1216$$

$$D_2 = \begin{vmatrix} 7 & -320 \\ -1 & -256 \end{vmatrix} = -1792 - 320 = -2112$$

$$V_1 = \frac{D_1}{D} = \frac{-1216}{20} = -60.8$$

$$V_2 = \frac{D_2}{D} = \frac{-2112}{20} = -105.6$$

$$I_3 = \frac{V}{R_3}$$

$$= \frac{V_1 - V_2}{R_3}$$

$$= \frac{(-60.8) - (-105.6)}{64}$$

$$= 0.7\,A$$

THE END