Set 2 CBCGS

GShukla

Choice based

Questions should be —
WRITTEN IN LEGIBLE HANDWRITING IN BLACK INK.
SIGNS, SKETCHES OR FIGURES IF ANY BE DRAWN IN NEAT BLACK INK,
so as to avoid mistakes in the printed question papers.

Duration 03 Hours. QP code 24698 Total Marks assigned to the paper 80

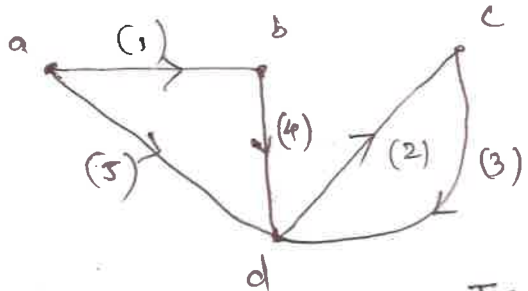
Q. No.		Marks

N.B. :

Solution

Q.1)a

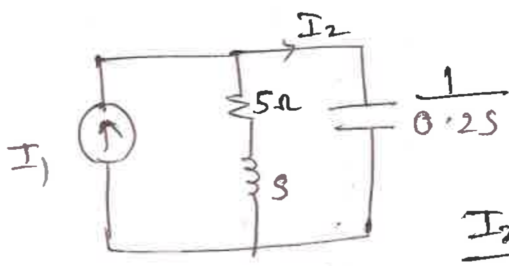
$$A_a = \begin{array}{c c} & \begin{array}{ccccc} 1 & 2 & 3 & 4 & 5 \end{array} \\ \begin{array}{c} a \\ b \\ c \\ d \end{array} & \begin{bmatrix} 1 & 0 & 0 & 0 & 1 \\ -1 & 0 & 0 & 1 & 0 \\ 0 & -1 & 1 & 0 & 0 \\ 0 & 1 & -1 & -1 & -1 \end{bmatrix} \end{array} \longrightarrow (01)$$



(02)

No. of possible trees $\det\{A A^T\} = 06$ (02)

Q.1 b).



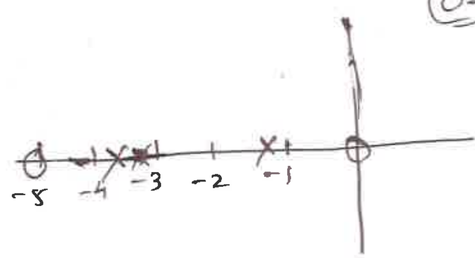
$$I_2 = \frac{5+S}{5+S+\frac{1}{0.25S}} I_1 \quad (02)$$

$$\frac{I_2}{I_1} = \frac{5+S}{5+S+\frac{5}{S}} = \frac{5S+S^2}{5S+S^2+5}$$

$$\frac{I_2}{I_1} = \frac{S(S+5)}{S^2+5S+5} \quad (02)$$

(01) zero at $S=0$ $S=-5$

poles at $S = -3.618, -1.382$



Q. No. | Marks

c).

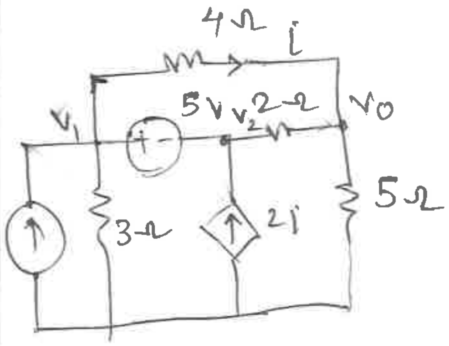
s^5	1	4	4
s^4	2	6	3
s^3	1	$5/2$	
s^2	$7/2$	3	
s^1	$23/14$		
s^0	3		

(03)

polynomial is hurwitz. (02)

d) state initial conditions (02)
significance (03)

Q 2 a)



$V_1 - 5 - V_2 = 0.$ — (01)

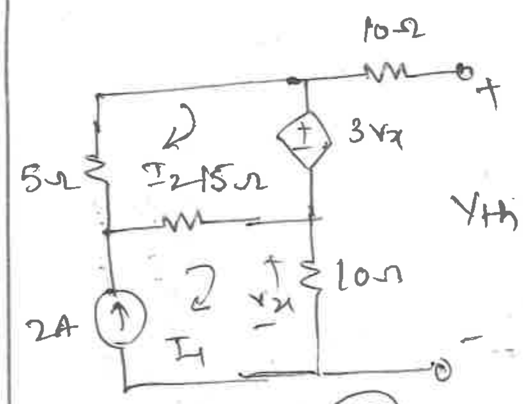
$2 + 2i = \frac{V_1}{3} + \frac{V_1 - V_0}{4} + \frac{V_2 - V_0}{2}$ — (02)

$\frac{V_1 - V_0}{4} = \frac{V_0 - V_2}{2} + \frac{V_0}{5}$ — (01)

$i = \frac{V_1 - V_3}{4}$ — (01)

simplificatn & answer (05) $V_0 = 0.792V$

b)



To find V_{th} :- (03)

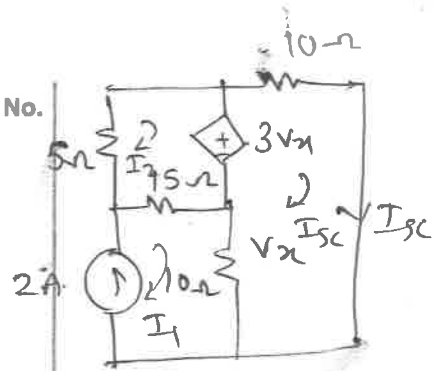
$I_1 = 2A.$

$V_x = 10 I_1 = 20 V.$

$V_{th} = 4 V_x = 80 V.$

To find Isc — (05)

Q. No. | Marks



$$-5I_2 - 3V_x - 15(I_2 - I_1) = 0$$

$$-10(I_{sc} - I_1) + 3V_x - 10I_{sc} = 0$$

$$V_x = 10(I_1 - I_{sc})$$

$$I_1 = 2$$

$$I_{sc} = 1.6\,A$$

$$R_{th} = \frac{V_{th}}{I_{sc}} = 50\,\Omega = R_L \longrightarrow (02)$$

Q. 3 a). Defination & example (03) marks for each

b)

$$A_a = \begin{array}{c|c} & \begin{array}{ccccccc} 1 & 2 & 3 & 4 & 5 & 6 & 7 \end{array} \\ \begin{array}{c} 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{array} & \begin{bmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & -1 & -1 & 1 & 0 \\ 0 & -1 & 0 & 0 & 0 & -1 & 1 \\ 0 & 0 & -1 & 1 & 0 & 0 & -1 \\ -1 & 1 & 1 & 0 & 0 & 0 & 0 \end{bmatrix} \end{array} \longrightarrow (04)$$

$$B = \begin{array}{c} 3 \\ 6 \\ 7 \end{array} \begin{bmatrix} 1 & 0 & 1 & 1 & -1 & 0 & 0 \\ -1 & -1 & 0 & 0 & 1 & 1 & 0 \\ 1 & 1 & 0 & 1 & -1 & 0 & 1 \end{bmatrix}$$

$$Q = \begin{array}{c|c} & \begin{array}{ccccccc} 1 & 2 & 3 & 4 & 5 & 6 & 7 \end{array} \\ \begin{array}{c} 1 \\ 2 \\ 4 \\ 5 \end{array} & \begin{bmatrix} 1 & 0 & -1 & 0 & 0 & 1 & -1 \\ 0 & 1 & 0 & 0 & 0 & 1 & -1 \\ 0 & 0 & -1 & 1 & 0 & 0 & -1 \\ 0 & 0 & 1 & 0 & 1 & -1 & 1 \end{bmatrix} \end{array} \longrightarrow (05)$$

(05) ← with explanation for B & Q.

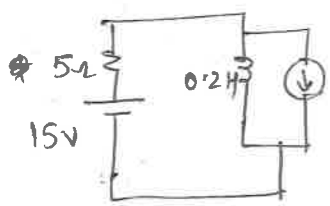
(10)

Q 4 a). $t < 0$

$$i(0^-) = i(0^+) = 2\,A \longrightarrow (03)$$

$t > 0$.

$$15 = 5i + 0.2\frac{di}{dt}$$



(02)

$$i(t) = \frac{75}{25} + k e^{-25t} \text{ —— } (02)$$

$$i(0) = 2 = 5 + k e^{-25 \times 0}$$

$$\underline{i(t) = 3 - e^{-25t}} \quad (03)$$

Q. No. Marks

Q.4 b) $V_2 = \frac{1}{6} I_b \qquad \therefore I_b = 6V_2$ — (01)

$I_b = \frac{V_a - V_2}{\frac{1}{2s}}$ — (01)

$6V_2 = \frac{V_a}{2s} - \frac{V_2}{2s} \qquad \frac{V_a}{2s} = 6V_2 + \frac{V_2}{2s}$

$\therefore V_a = (12s+1)V_2 \longrightarrow$ (02)

$I_1 = \frac{V_a}{\frac{1}{2s}} + I_b = (12s+1)\cdot 2s V_2 + 6V_2$ — (01)

$I_1 = (24s^2 + 2s + 6)V_2$

$V_1 = \left[\frac{\frac{3}{2} \times \frac{3}{2s}}{\frac{3}{2} + \frac{3}{2s}} + 1\right] I_1 + V_a$ — (02)

$= \left(\frac{6s+15}{6s+6}\right) I_1 + (12s+1)V_2$

$= \left(\frac{6s+15}{6s+6}\right)(24s^2+2s+6)V_2 + (12s+1)V_2$

$\frac{V_2}{V_1} = \frac{6s+6}{(6s+15)(24s^2+2s+6) + (12s+1)(6s+6)} \longrightarrow$ (03)

Q.5 a) $V_2 = 6(I_2 + I_3)$ — I (01)

$V_1 = h_{11}I_1 + h_{12}I_2$
$I_2 = h_{21}I_1 + h_{22}I_2$ (01)

$V_1 - 0.1V_2 - 4I_3 - 6(I_3 + I_2) = 0$. — II — (01)

$I_1 - I_3 = 2I_2 \Rightarrow I_3 = I_1 - 2I_2$ — III — (01)

$I_2 = I_1 - \frac{1}{6}V_2 \longrightarrow$ (02) $\Rightarrow h_{21} = 1; \quad h_{22} = -\frac{1}{6}$

$V_1 = -4I_1 + \frac{73}{30}V_2 \longrightarrow$ (03) $\qquad h_{11} = -4 \quad h_{12} = \frac{16}{60}$

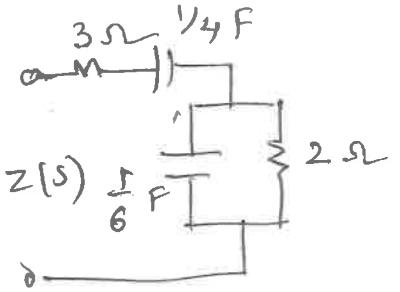
$h = \begin{bmatrix} 1 & -\frac{1}{6} \\ -4 & \frac{79}{30} \end{bmatrix}$ — (01)

Q.5 b) $\begin{bmatrix} A & B \\ C & D \end{bmatrix} = \begin{bmatrix} A_1 & B_1 \\ C_1 & D_1 \end{bmatrix} \begin{bmatrix} A_2 & B_2 \\ C_2 & D_2 \end{bmatrix}$ Proof.

Q. No. | Marks

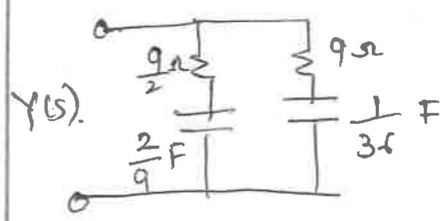
Q 6 a) Foster I : — 05

$$Z(s) = 3 + \frac{4}{s} + \frac{6}{s+3}.$$



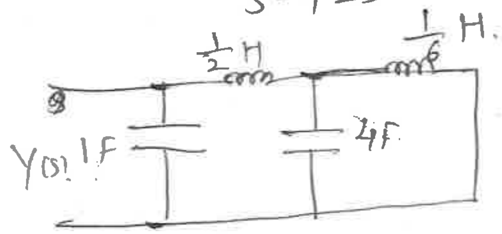
Foster II — 05

$$Y(s) = \frac{\frac{2}{9}s}{s+1} + \frac{\frac{s}{9}}{s+4}.$$



(b) Cauer – I — 05

$$Y(s) = \frac{s^4 + 4s + 3}{s^3 + 2s}$$



Cauer – II

$$Y(s) = \frac{3 + 4s^2 + s^4}{2s + s^3}$$