USN										

CMR INSTITUTE OFTECHNOLOGY

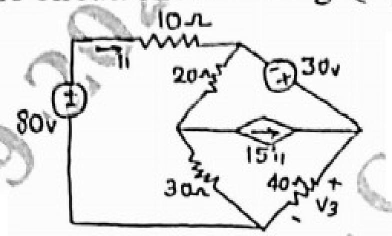
Internal Assesment Test - II

Sub:	**Electric Circuit Analysis**							Code:	18EE32
Date:	17/02/2021	Duration:	90 mins	Max Marks:	50	Sem:	3rd	Branch:	EEE
Answer Any FIVE FULL Questions									

Marks/CO/RBT

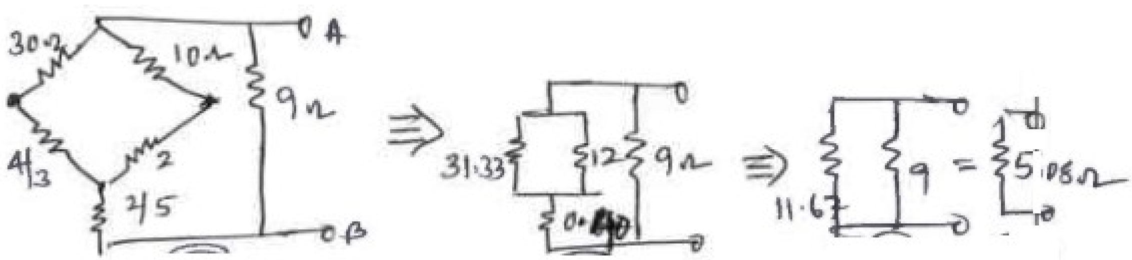
1. (

Determine voltage V_3 for the circuit shown in Fig.Q1(a), using Mesh analysis method.



(5)(CO1)(L3)

(b) Find the equivalent resistance R_{AB} using Delta-Star Transformation. (5)(CO2)(L3)



$R_{AB} = 5.08\Omega$

2. (a) Use node equations to determine what value of 'E' will cause Vx to be zero for the network shown in fig. (5)(CO2)(L3)

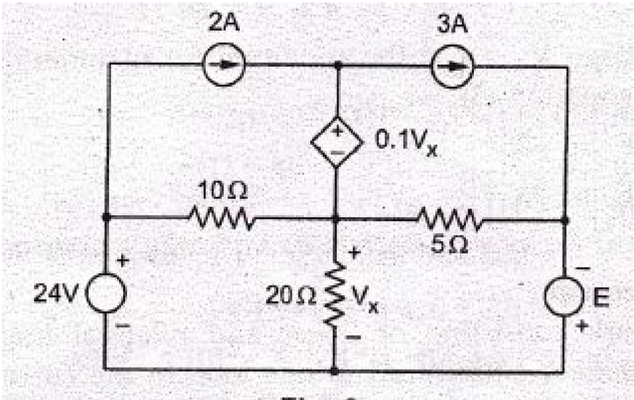
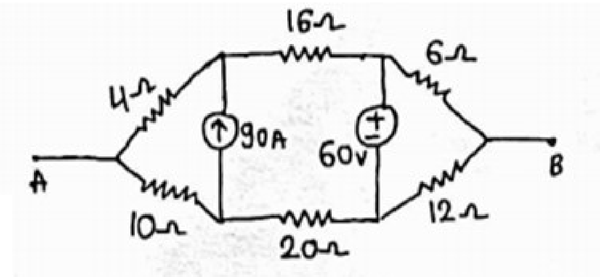
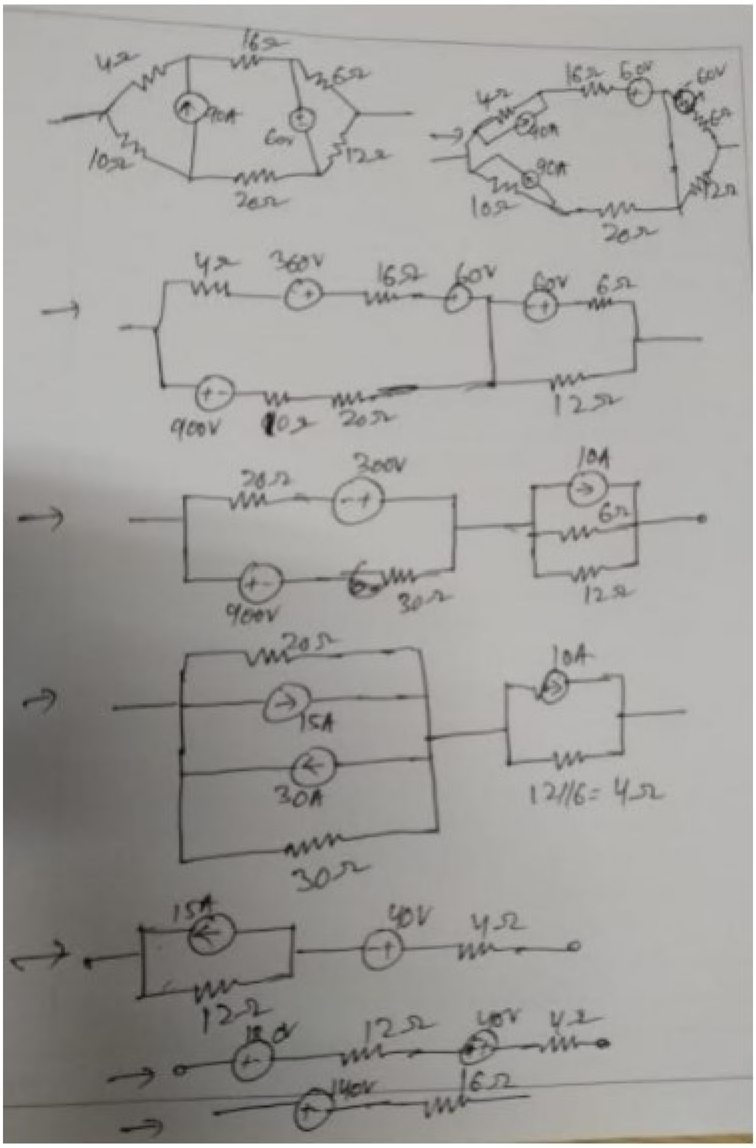


Fig. 6

(b) Convert the given circuit into a single voltage source in series with a single resistance using source transformation & shifting. (5)(CO2)(L3)





3. a) For the network shown in Fig. 2 determine the node voltages V1, V2, V3and V4 using nodal analysis. (5)(CO2)(L3)

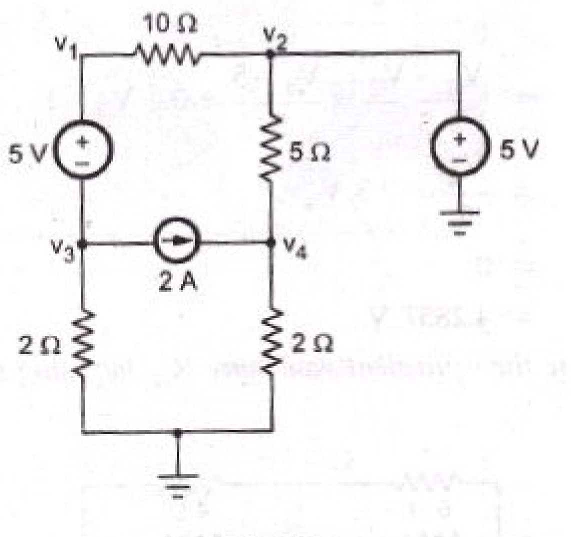
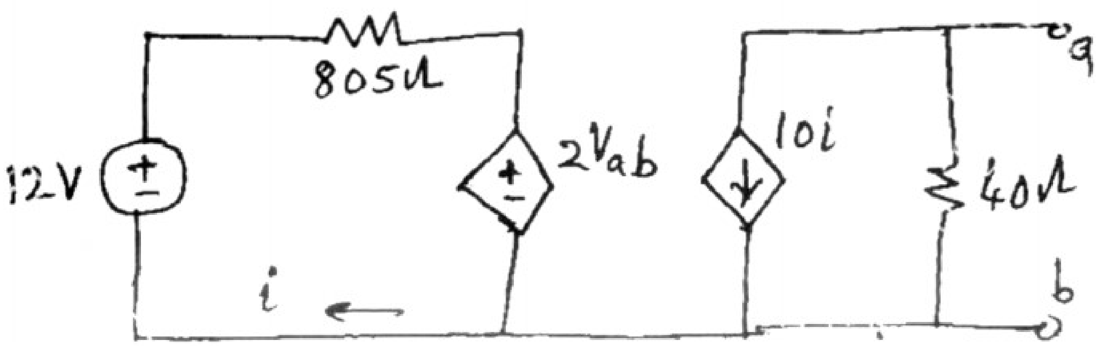


Fig. 2

(b) Find Thevenin's& Norton's equivalent circuit for the given network. (5)(CO2)(L3)



Apply KVL to loop 1

$12 - 805i - 2V_{ab} = 0$

$805i + 2V_{ab} = 12$ —(1)

Apply KVL to loop 2

$V_{ab} = 40(-10i)$

$i = -\frac{V_{ab}}{400}$ —(2)

sub (2) in (1)

$805\left(\frac{-V_{ab}}{400}\right) + 2V_{ab} = 12$

$-2.0125 V_{ab} + 2V_{ab} = 12$

$-0.0125 V_{ab} = 12$

$V_{oc} = V_{ab} = -960V$

$\therefore i = -\frac{V_{ab}}{400}$

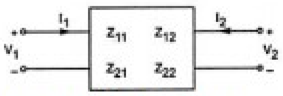
$= \frac{-(-960)}{400} = 2.4A$

$i_{40} = 10i = 10 \times 2.4 = 24A$ (a to b)

4. Describe about Z-parameter & draw its equivalent circuit. Derive the relationship between Z & ABCD parameters. (10)(CO3)(L3)

Two port network parameters:

Z parameters.



It is also called as impedance parameters or open circuit parameters.

The Z parameters equations are obtained by considering I_1 and I_2 of the network as independent variables and V_1 and V_2 are the dependent variables. The impedance parameters are obtained by expressing voltages at two ports in terms of currents at two ports.

$$V_1 = f_1(I_1, I_2)$$

$$V_2 = f_2(I_1, I_2)$$

In equation form

$$V_1 = Z_{11} I_1 + Z_{12} I_2$$
$$V_2 = Z_{21} I_1 + Z_{22} I_2$$

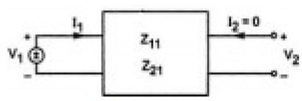
In matrix form

$$[V] = [Z][I]$$

$$\begin{bmatrix} V_1 \\ V_2 \end{bmatrix} = \begin{bmatrix} Z_{11} & Z_{12} \\ Z_{21} & Z_{22} \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix}$$

Individual Z parameters

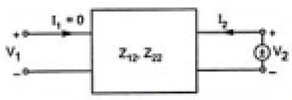
Sub I_2=0 (Output port is open circuited)



$$V_1 = Z_{11} I_1 \qquad V_2 = Z_{21} I_1$$

$$Z_{11} = \frac{V_1}{I_1} \qquad Z_{21} = \frac{V_2}{I_1}$$

Sub I_1=0(Input port is open circuited)



$$V_1 = Z_{12} I_2 \qquad V_2 = Z_{22} I_2$$

$$Z_{12} = \frac{V_1}{I_2} \qquad Z_{22} = \frac{V_2}{I_2}$$

Z_{11}=Open circuit input driving point impedance

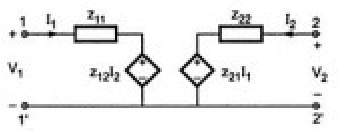
Z_{22}=Open circuit output driving point impedance

Z_{12}=Open circuit forward transfer impedance

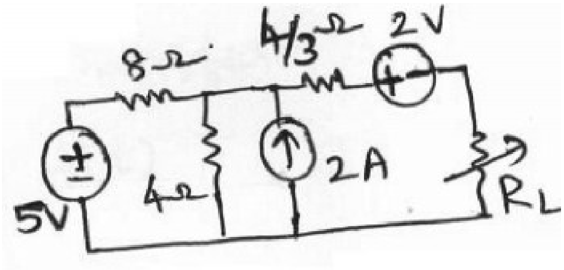
Z_{21}=Open circuit reverse transfer impedance

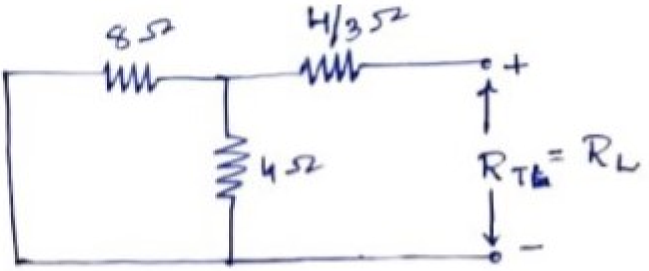
Where Z_{11}, Z_{12}, Z_{21} and Z_{22} are called as impedance parameters. These parameters are defined only when the current in any one of the port is zero.

Equivalent Circuit



5. (a) Find the value of R_L for which maximum power is delivered to it. (6)(CO3)(L3)





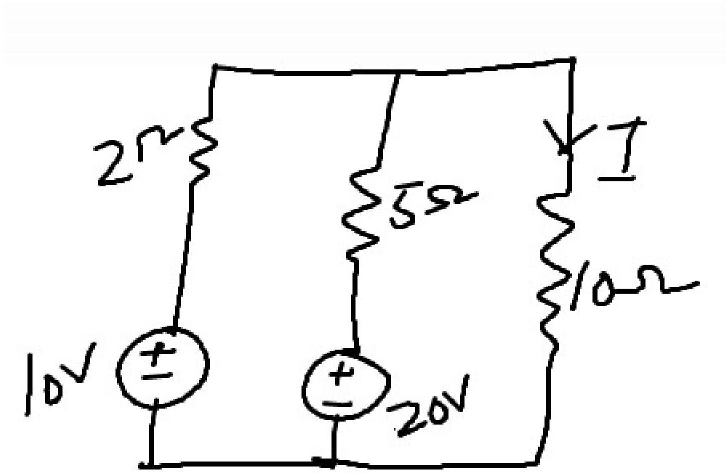
$$R_T = R_L \Rightarrow \frac{8(4)}{8+4} + \frac{4}{3} = \frac{32}{12} + \frac{4}{3}$$

$$= \frac{32+16}{12}$$

$$= \frac{\cancel{48}\,4}{\cancel{12}}$$

$$R_T = R_L = 4\,\Omega$$

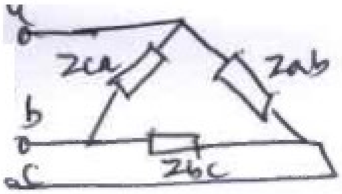
(b) Find currentI using Millman's Theorem. (4)(CO3)(L3)



6. a)

Determine the line currents and total power supplied to a delta connected load of $Z_{ab} = 10\angle 60^\circ\,\Omega$, $Z_{bc} = 20\angle 90^\circ\,\Omega$ and $Z_{ca} = 25\angle 30^\circ\,\Omega$. Assume a 3 phase, 400 V, ABC system.

(5)(CO5)(L3)



$V_L = V_{ph} = 400V$.

$V_{ab} = 400\angle 0^\circ$, $V_{bc} = 400\angle -120^\circ$, $V_{ca} = 400\angle 120^\circ V$

phase currents

$$I_{ab} = \frac{V_{ab}}{Z_{ab}} = \frac{400\angle 0^\circ}{10\angle 60} = 40\angle -60^\circ A$$

$$I_{bc} = \frac{V_{bc}}{Z_{bc}} = \frac{400\angle -120^\circ}{20\angle 90^\circ} = 20\angle -210^\circ A$$

$$I_{ca} = \frac{V_{ca}}{Z_{ca}} = \frac{400\angle 120^\circ}{25\angle 30} = 16\angle 90^\circ A$$

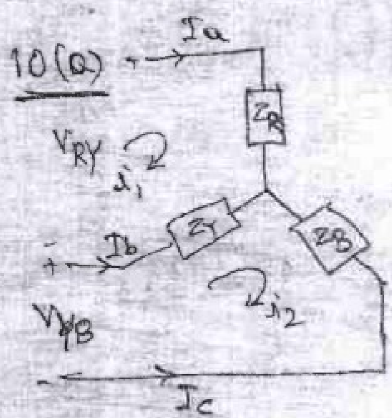
$I_a = 54.45\angle -68.45$, $I_b = 58.173\angle 129.88$ $I_c = 18.316\angle 19.1$

$P = P_{ab} + P_{bc} + P_{ca} = 13.542\ KW$

b)

Determine the line currents in an unbalanced star connected load supplied from a symmetrical 3 phase, 440 V system. The branch impedances are $Z_R = 4\angle 30^0\,\Omega$, $Z_Y = 10\angle 45^0\,\Omega$ and $Z_B = 10\angle 60^0\,\Omega$. The phase sequence is RYB.

(5)(CO5)(L3)



1st loop:-

$-(4\angle 30^\circ)i_1 - (10\angle 45^\circ)i_1 + V_{RY} + (10\angle 45^\circ)i_2 = 0$

$V_{RY} = (4\angle 30^\circ)i_1 + (10\angle 45^\circ)i_1 - (10\angle 45^\circ)i_2$

$440\angle 0^\circ = (13.9\angle 40.73)i_1 - (10\angle 45)i_2 \quad \rightarrow (1)$

2nd loop:- $V_{YB} = -(10\angle 45^\circ)i_1 + (19.82\angle 52.7^\circ)i_2 \rightarrow (2)$

$$\begin{bmatrix} (13.9\angle 40.73^\circ) & (-(10\angle 45^\circ)) \\ -(10\angle 45^\circ) & (19.82\angle 52.7) \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \end{bmatrix} = \begin{bmatrix} 440\angle 0^\circ \\ 440\angle -120^\circ \end{bmatrix}$$

By Cramer's rule:- $i_1 = 39.7\angle -72.52^\circ$

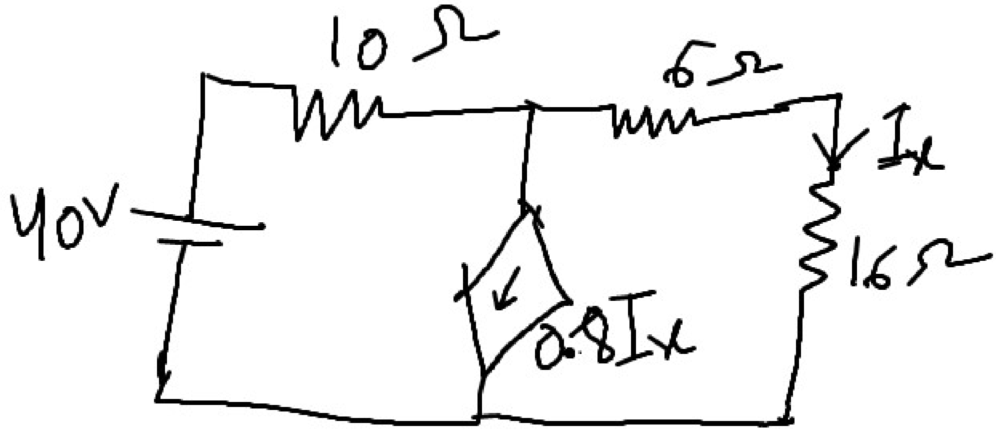
$i_2 = 29.26\angle -129.28^\circ$

line currents $I_a = i_1 = 39.7\angle -72.52^\circ\ A$

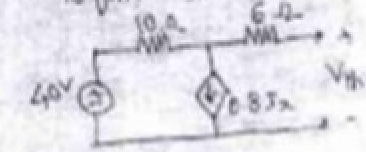
$I_b = i_2 - i_1 = \ldots - 34\angle 153.44\ A$

$I_c = -i_2 = 29.26\angle 50.72^\circ\ A$

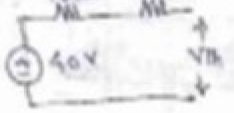
7. (a) Find current through 16Ω resistor using Norton's Theorem. (5)(CO3)(L3)



To find V_{th} :-

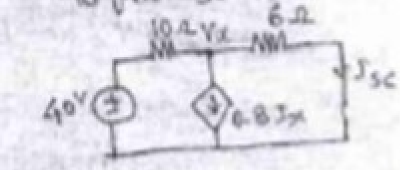


$I_x = 0 \rightarrow 0.8 V_x = 0$



$V_{th} = 40V$

To find I_{sc} :-



$I_{sc} = I_x$

KCL at node :-

$$0.8 I_x + \frac{V_x - 40}{10} + \frac{V_x}{6} = 0$$

$$0.8 I_{sc} + \frac{V_x - 40}{10} + I_{sc} = 0$$

$$1.8 I_{sc} + 0.1 V_x = 4$$

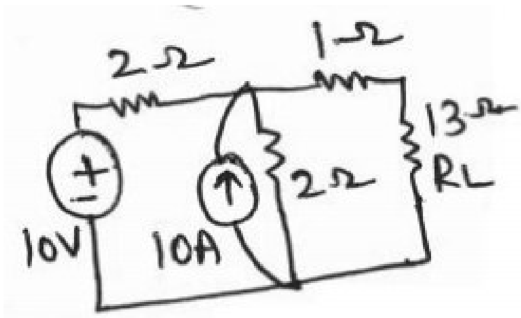
$$1.8 I_{sc} + 0.1(6 I_{sc}) = 4 \Rightarrow I_{sc} = 1.666 A$$

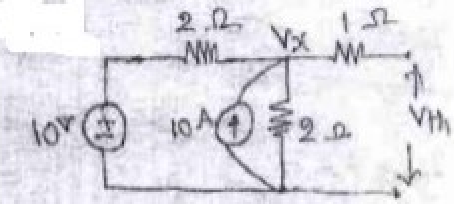
$$R_{th} = \frac{V_{th}}{I_{sc}} = \frac{40}{1.666} = 24\Omega \quad - 1M$$

$$I_{16\Omega} = \frac{1.666 \times 24}{24 + 16} = 1A \quad - 2M$$

-3-

(b)Find current through R_L using Thevenin's Theorem (5)(CO3)(L3)



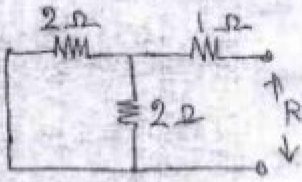


$V_{th} = V_x$

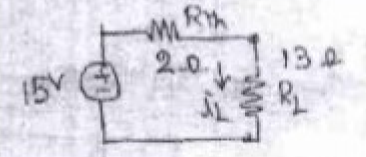
KCL @ node :-

$$10 = \frac{V_x}{2} + \frac{V_x - 10}{2}$$

$\therefore V_x = V_{th} = 15\ V$



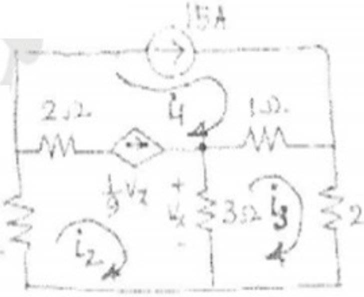
$$R_{th} = \frac{2 \times 2}{2+2} + 1 = 2\ \Omega$$



$$i_L = \frac{V_{th}}{R_{th} + R_L} = 1\ A$$

8. a)

Find the loop currents i_1, i_2 and i_3 using Mesh analysis for the network shown



(5)(CO1)(L3)

Loopequations: superMesh (comprising of ① & ② loops gets open circuited

$i_1 = 15A$; —①

$-i_1 - 3i_2 + 6i_3 = 0$ for Mesh ③ —②

$i_2 - i_1 = \frac{1}{9}V_x = \frac{1}{9}[3(i_2 - i_3)]$ or where $V_x = V/g$ a/c 3Ω

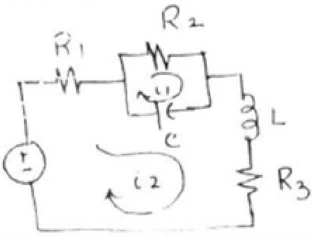
$-i_1 + \frac{2}{3}i_2 + \frac{1}{3}i_3 = 0$ —③

on Solving ①, ② and ③

$i_1 = 15A$, $i_2 = 17A$ and $i_3 = 11A$

b)

Write the equilibrium equations using KVL for the network shown in Fig.Q.2(b). Draw its dual and also write its equilibrium equations.



(5)(CO2)(L3)