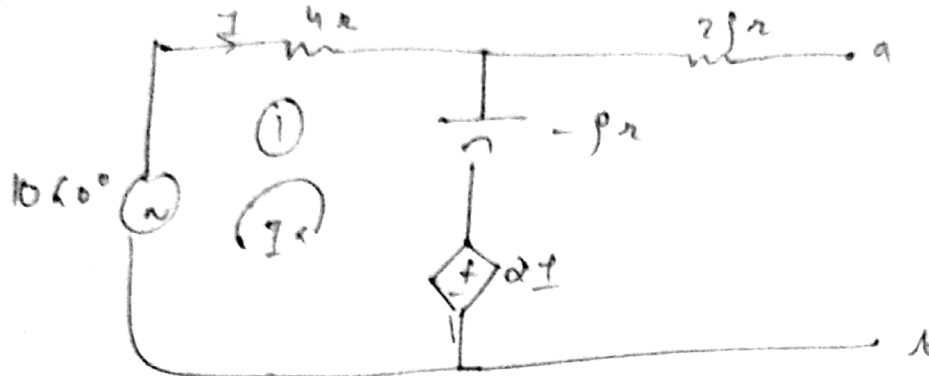


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Year	2020-21	
Title of the course	Network Analysis & Synthesis	EEEL 201

Q-1



for  $V_{th}$

In loop ①

$$-10\angle 0^\circ + 4I - j + 2I = 0$$

$$-10 + 6I - j = 0$$

$$I = \frac{10 + j}{6}$$

$$V_{th} = -j + 2I = -j + \frac{10}{3} + \frac{j}{3} = \left(\frac{10}{3} - \frac{2}{3}j\right)$$

$$V_{th} = \frac{10 - 2j}{3}$$

for  $I_{sc} = I_w$

②

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KVL in loop ①

$$-10 + 4I - j(I - I_w) + 2I = 0$$

$$-10 + (6 - j)I + jI_w = 0 \quad \dots (1)$$

KVL in ②

$$-2I - j(I_w - I) + j2I_w = 0$$

$$(-2 + j)I + jI_w = 0 \quad \dots (2)$$

from ① and ②

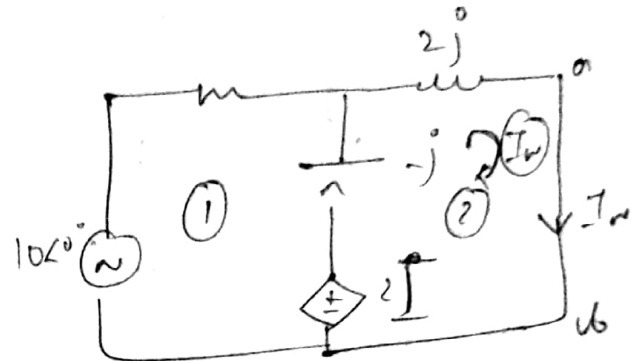
$$I = \frac{-5}{j - 4}$$

using  $I$  in eq<sup>n</sup> ② for  $I_w$

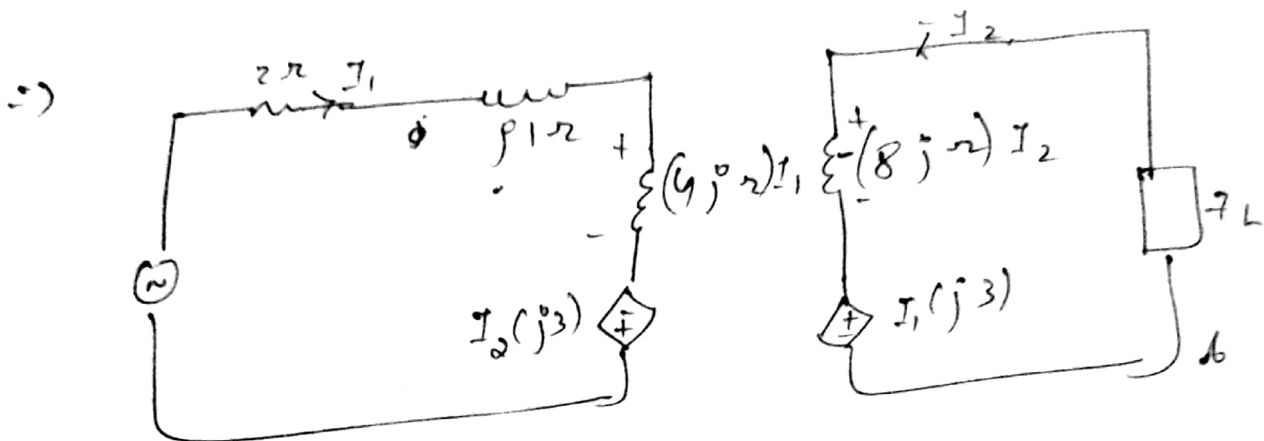
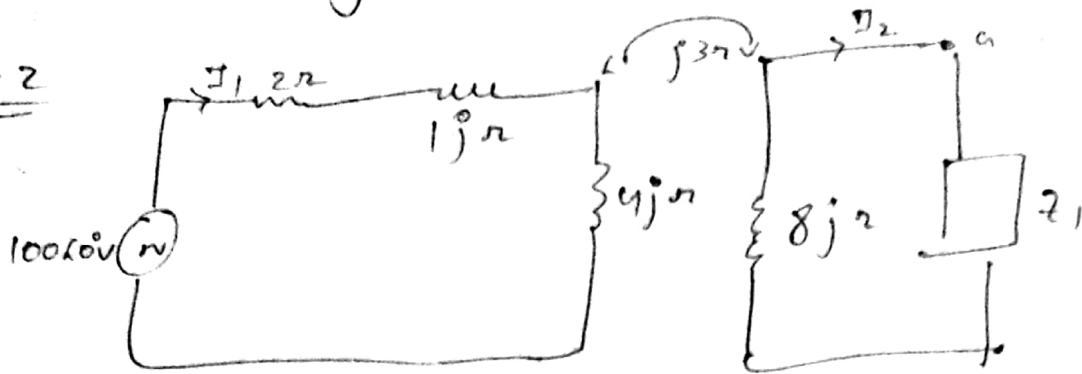
$$I_w = \frac{-5(2 - 9j)}{17}$$

$I_{th}$  will be same for both Thevenin and Norton

$$I_{th} = \frac{V_{th}}{I_n} = \frac{10 - 92}{3} \times \frac{17}{5(2 - 9j)} = -\frac{17}{15} \left( \frac{10 - 92}{2 - 9j} \right)$$



Q. 2



KVL in loop (1)

$$V_1 - 2I_1 - jI_1 - (I_1 \cdot 4j) + 3jI_2 = 0$$

$$V_1 = I_1 (2 + 5j) - 3jI_2$$

KVL in loop (2)

$$V_2 = -(8j)I_2 + 3jI_1$$

z parameters

Sheet Agmised	1912/00006
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$$[Z] = \begin{bmatrix} \cancel{7-2j} & 2+5j & -3j \\ & 3j & -8j \end{bmatrix}$$

$$|Z| = (2+5j)(-8j) + 9j^2$$

$$= -16j - 40j - 9$$

$$|Z| = -9 - 56j$$

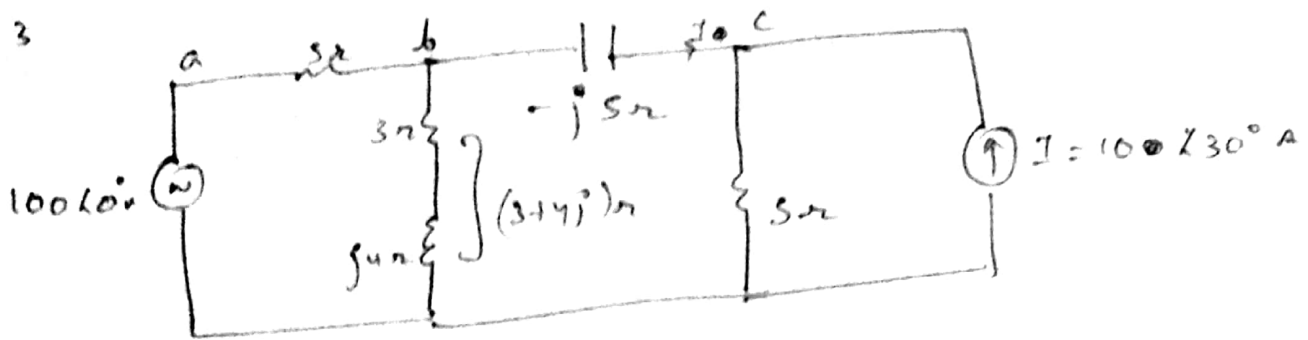
for maximum power transfer.

$$Z_1 = |Z| = (-9 - 56j) \Omega$$

$$|Z| = -16j + 40 - 19$$

$$= 31 - 16j \underline{\underline{m}}$$

Q. 3



new voltage source short circuit

Using nodal for node b

$$\frac{V_b - V_a}{5} + \frac{V_b}{3+4j} + \frac{V_b - V_c}{-j5} = 0 \quad \text{--- (1)}$$

for node c

$$\frac{V_c - V_b}{-j5} + \frac{V_c}{5} - 10\angle30^\circ = 0 \quad \text{--- (2)}$$

and

$$V_a = 100\angle0^\circ = 100$$

from eq<sup>n</sup> (1) and (2)

$$V_b = \frac{-1200 - 1392j}{60} = \frac{-2919 - 1392j}{60}$$

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$$V_c = \frac{-400j - 1092 - 1208j}{60} - 1719$$

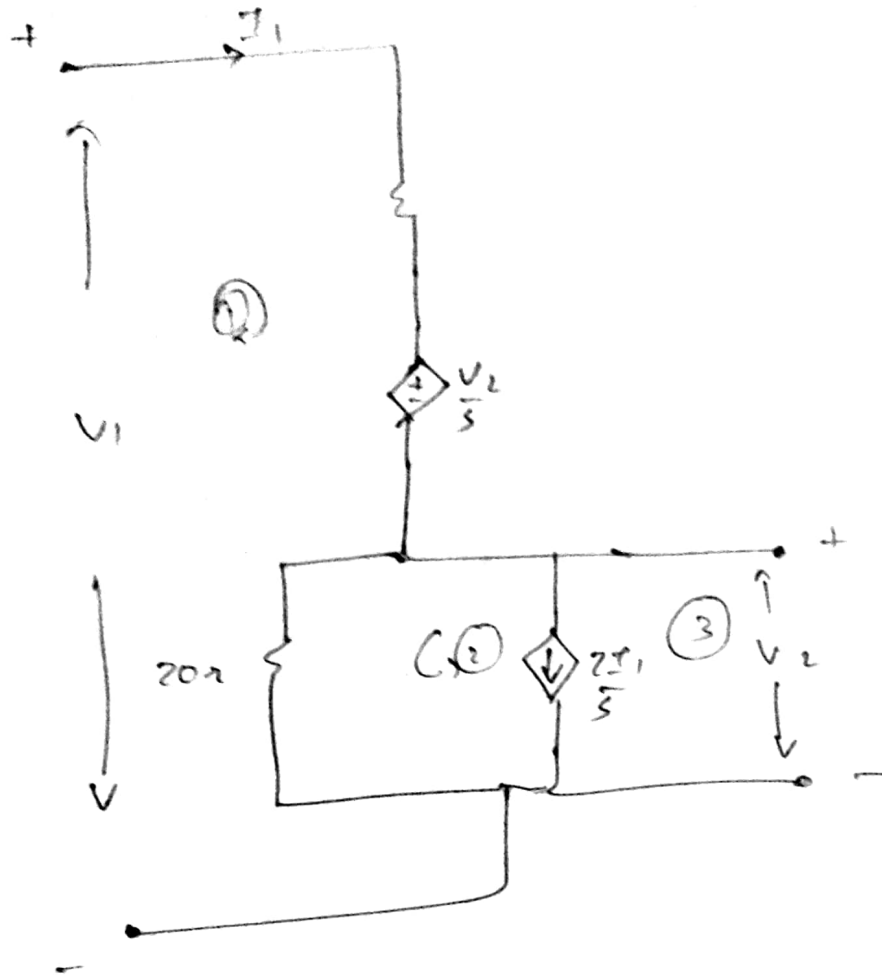
$$= \frac{-2811 - 1608j}{60}$$

$$I = \frac{V_b - V_c}{-js} = \frac{-5730 - 3000j}{-js \times 60}$$

$$= -19.1j + 10$$

$$I = 10 - 19.1j$$

Q-4



KVL in loop ①

$$-5I_1 - \frac{V_2}{5} - 20(I_1 + I_2 - \frac{2I_1}{5}) + V_1 = 0$$

$$(-25I_1 + 8I_1) - 20I_2 + V_1 - \frac{V_2}{5} = 0$$

$$-17I_1 - 20I_2 + V_1 - \frac{V_2}{5} = 0 \quad \text{--- (1)}$$

Supermesh in ② & ③

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$$-20(I_1 + I_2 - \frac{2I_1}{5}) + V_2 = 0$$

$$V_2 = 20 \left( I_1 + I_2 - \frac{2I_1}{5} \right)$$

$$\boxed{V_2 = 12I_1 + 20I_2} \dots (2)$$

Now using  $V_2$  from (2) in (1).

$$V_1 = 20I_2 + \frac{12}{5}I_1 + \frac{20}{5}I_2 + 12I_1$$

$$\boxed{V_1 = 24I_2 + 19.4I_1} \dots (3)$$

sol on solving (2) and (3) and

comparing we get  $z$ -parameters

$$z_{11} = 19.4 \Omega$$

$$z_{12} = 12 \Omega$$

$$z_{22} = 24 \Omega$$

$$z_{21} = 20 \Omega$$

$$\text{Now } [Y] = [Z]^{-1}$$



Sheet 19/12/2006

19/12/2006

$$Y = \frac{\text{adj}(-Z)}{1.91}$$

$$1.91 = 100 \Omega$$

$$Y_{11} = \frac{Z_{22}}{1.91} = \frac{200}{100} = \frac{1}{5} \text{ mho.}$$

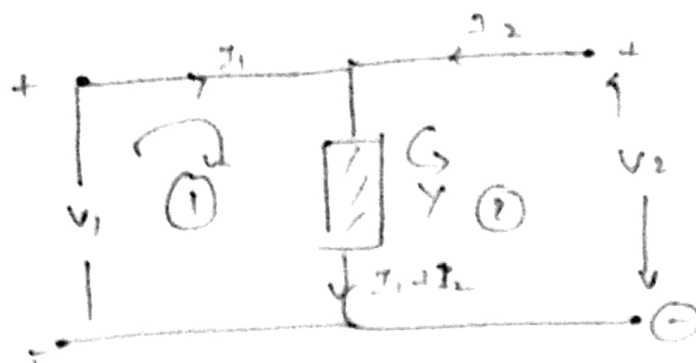
$$Y_{21} = -\frac{Z_{21}}{1.91} = -\frac{12}{100} = -0.12 \text{ mho.}$$

$$Y_{12} = -\frac{Z_{12}}{1.91} = -\frac{24}{100} = -0.24 \text{ mho.}$$

$$Y_{22} = \frac{Z_{11}}{1.91} = \frac{19.4}{100} = 0.194 \text{ mho.}$$

$$[Y] = \begin{bmatrix} 0.2 & -0.24 \\ -0.12 & 0.194 \end{bmatrix}.$$

Q 3



for  $Y$

$$I_1 = Y_{11} V_1 + Y_{12} V_2$$

$$I_2 = Y_{21} V_1 + Y_{22} V_2$$

$$Z = [Y]^{-1}$$

KVL in loop ①

$$-V_1 + Y(I_1 + I_2) = 0$$

$$V_1 = Y I_1 + Y I_2$$

KVL in loop ②

$$-V_2 + Y(I_1 + I_2) = 0$$

$$V_2 = Y I_1 + Y I_2$$

on comparing,  $Z$  - parameters.

$$Z = \begin{bmatrix} Y & Y \\ Y & Y \end{bmatrix}$$