# BE (Mid-Term Exam).

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Question no. 1) Part a)

Answer: Importance of Thevinin's Theorem:

1) With Thevinin Theorem, if Circuit contain's multiple series and parallel connected components, including voltage and or current sources and resistors, which (Thevinin Theorem) will determine the current flowing and voltage level at a point in the circuit, with other method it can be difficult and complex

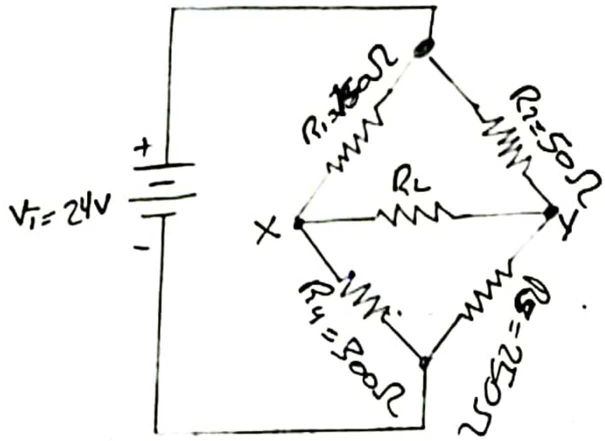
2) Thevinin's Theorem is also important in such a way that, if the current is flowing at a point in a circuit, it can be calculated without knowing voltage at intermediate points in the circuit.

3) Thevinin's Theorem is sometimes used in conjunction with Norton's theorem, which is the "current source in parallel with a single resistor" equivalent.

⊙ Norton's Theorem:

"Any linear circuit containing several energy sources and resistances can be replaced by a single Constant Current generator in parallel with a Single Resistor."

Question no. 1; part b;




Solution;

$\odot$ $$R_T = \left(\frac{1}{R_{14}} + \frac{1}{R_{25}}\right)^{-1}$$

$$R_T = \left(\frac{1}{R_1+R_4} + \frac{1}{R_2+R_5}\right)^{-1}$$

$\therefore$ $\boxed{R_{14} = R_1 + R_4.}$ $\boxed{R_{25} = R_2 + R_5}$

$$R_T = \left(\frac{1}{130+300} + \frac{1}{50+250}\right)^{-1}$$

$$R_T = \left(\frac{1}{430} + \frac{1}{300}\right)^{-1}$$

$$R_T = \left(\frac{73}{12900}\right)^{-1}$$

$\boxed{R_T = 180\,\Omega}$ (Total Resistance of circuit).

$\odot$ $I_T = V_T / R_T$

$$= \frac{24}{180}$$

$\boxed{I_T = 0.14 (A)(amp.)}$ (Total current of circuit).

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⊙ Now voltage through $R_2$:

$$V_{R_2} = \frac{R_2}{R_2 + R_5} \times V_T$$

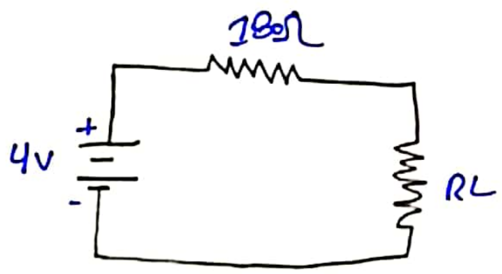
$$\Rightarrow \frac{50}{50+250} \times (24)$$

$$\Rightarrow \frac{1200}{300}$$

$\boxed{V_{R_2} = 4V}$ (Voltage across $R_2$).

⊙ Thevinin voltage = $V_{TH} = V_{R_2}$.

⊙




⊙ $R_L = 100\Omega$ (i)

$R_T = 100 + 180$

$\boxed{R_T = 280\Omega}$

⊙ $I_T = 4/280$

$\boxed{I_T = 0.014A}$

∴ Since it is a series Circuit so $I_L = I_T$.

$$V = \frac{R_L}{R_T} \times V_T$$

$$V_L = \frac{100}{280} \times 4$$

$\boxed{V_L = 1.428 V_L}$

⊙ Now;

(On next page)

⊙ $R_L = 200\Omega$ (iii)

$R_T = 200 + 180$

$\boxed{R_T = 380\Omega}$

$I_T = 4/380$

$\boxed{I_T = 0.0105A}$.

∴ Since it is seriu circuit so;

$\boxed{I_L = I_T}$

⊙ $V_L = \frac{200}{380} \times 4$

$\boxed{V_L = 2.105V}$

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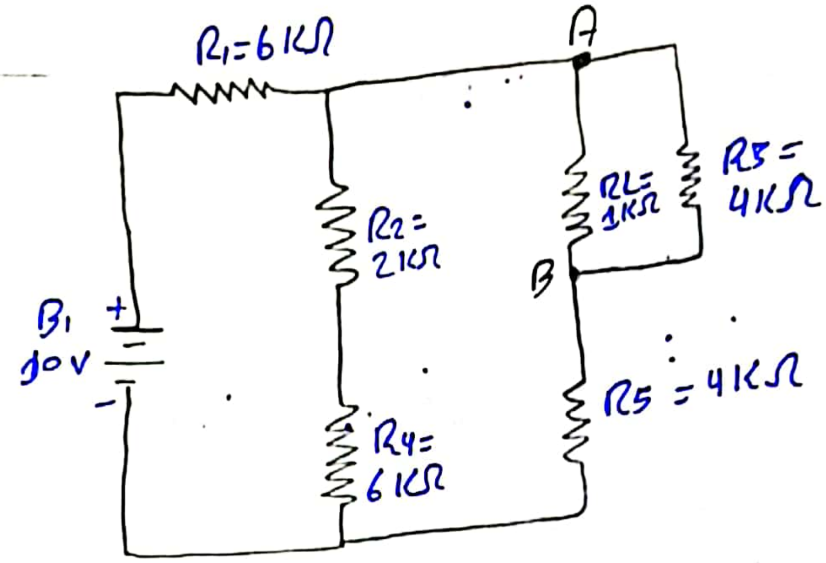
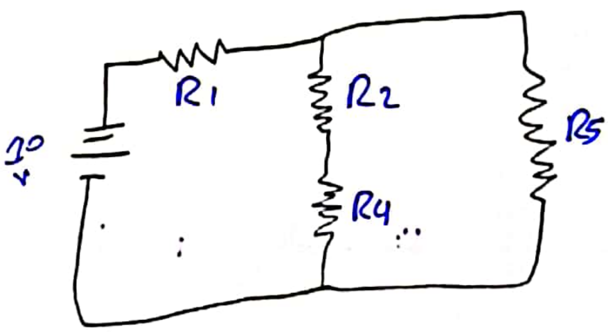
Question no. 3




Solution:

⊙ (Shorting A-B)




⊙ $R_T = \left(\frac{1}{R_2+R_4} + \frac{1}{R_5}\right)^{-1} + R_1$

$= \left(\frac{1}{2000+6000} + \frac{1}{4000}\right)^{-1} + 6000$

$\boxed{R_T = 8666.7\Omega}$

⊙ $I_T = V/R$

$= 10/8666.7\Omega$

$\boxed{I_T = 1.153 \times 10^{-3} \text{ mamp}}$

$\odot\ I_{R5} = \dfrac{4000}{8666.7} \times 1.155 \times 10^{-3}$

$$\boxed{I_{R5} = 5.32 \times 10^{-4}\ \text{amp}}$$

OR

$$\boxed{I_{R5} = 0.000532\ \text{amp.}}$$

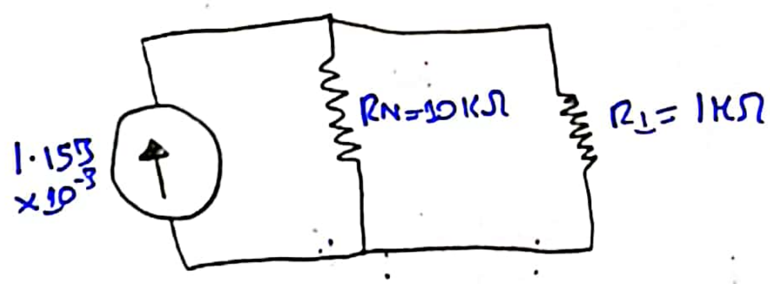
⊙ Opening point A–B.

$$R_T = \left(\frac{1}{2000+6000} + \frac{1}{4000+4000}\right) + R_1$$

$$R_T = 4000 + 6000$$

$$\boxed{R_T = 10\,K\Omega} \Rightarrow \boxed{R_N = R_T = 10\,K\Omega}$$

⊙ Circuit.

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Part a)

Answer: Norton's theorem uses a current source, whereas Thevinin's theorem uses voltage source.

Q5 Part b)

Answer)

(.) Current source is the dual of voltage source.

(.) voltage source is the combination of two terminals of like anode and cathode.

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# BE (Mid-Term Exam)

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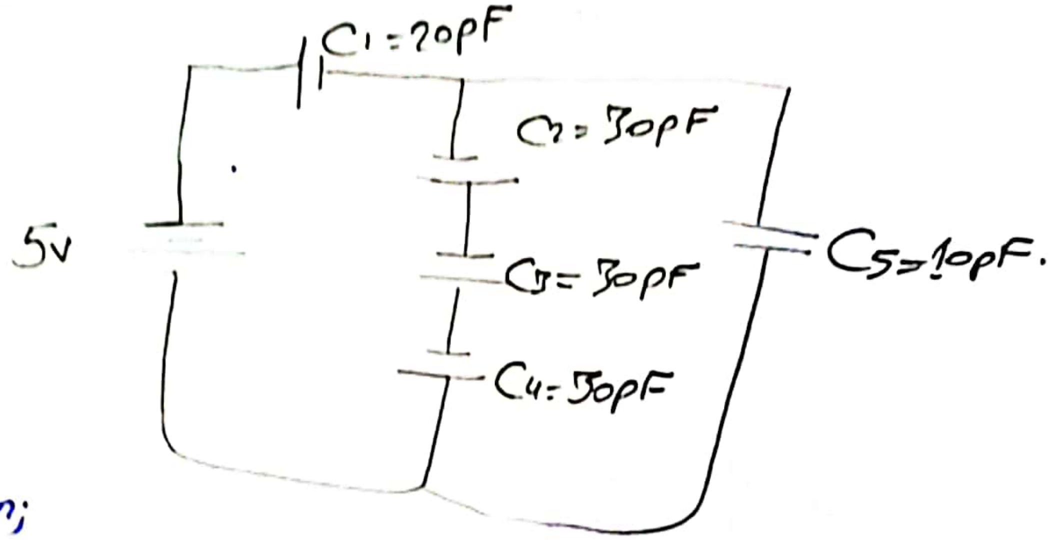
Question no. 4:




Solution;

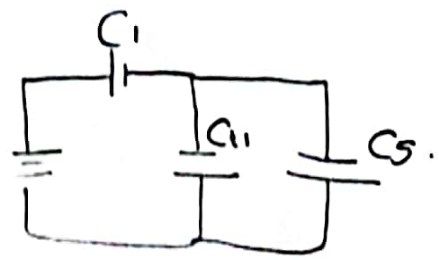
$C_1$ and $C_3$ and $C_4$ are in series with each other.

Sum of series Capacitance = $C_{t1} = \left[\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}\right]^{-1}$

$\Rightarrow \left[\frac{1}{30} + \frac{1}{30} + \frac{1}{30}\right]^{-1}$

$\boxed{C_{t1} = 10pF}$

Now Circuit;



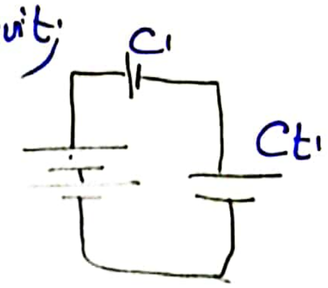

now; $\therefore C_{t1} \parallel C_5$.

$C_{t2} = C_{t1} + C_5$

$= 10pF + 10pF$

$\boxed{C_{t2} = 20pF}$

⊙ Now Circuit;




⊙ ∴ Sum of series circuit:

$$C_t = \left[\frac{1}{C_1} + \frac{1}{C_{t1}}\right]^{-1}$$

$$= \left[\frac{1}{20} + \frac{1}{20}\right]^{-1}$$

$C_t = 10\,pF$

⊙ Total Capacitance = 10pF

or;

$C_T = 10 \times 10^{-12} F$

⊙ Total Charge ($Q_T$);

$V_T = 5V$

$C_T = 10^{-12} F$

$$V_T = \frac{Q_T}{C_T}$$

$$\Rightarrow 5 = \frac{Q_T}{10^{-12}}$$

$\Rightarrow$ $Q_T$ = Total charge = $5 \times 10^{-12}$ coulomb (C)

Question no 5; Part 1;
Part a;

a) $\theta = \frac{5\pi}{4}$

Solution;

$\theta \longrightarrow$ degree;

$$degree = \left(\frac{180^\circ}{\pi}\right) \times rad.$$

$$degree = \left(\frac{180^\circ}{\pi}\right) \times \left(\frac{5\pi}{4}\right)$$

$$\boxed{degree = 225^\circ}$$

Now;

$$V = V_m \sin\theta$$

$$V = 340 \times \sin 225^\circ$$

$$\boxed{V = -240.41}$$

Part b;

b) $\theta = \frac{\pi}{4}$.

Solution;

$\longrightarrow$ degree;

$$degree = \left(\frac{180^\circ}{\pi}\right) \times \left(\frac{\pi}{4}\right)$$

$$\boxed{degree = 45^\circ}$$

Now;

$$V = V_m \sin\theta.$$

$$V = 340 \times \sin 45^\circ$$

$$\boxed{V = 240.41}$$

Part c;

c) $\theta = \frac{3\pi}{2}$

Solution;

$\rightarrow$ degree;

$$degree = \left(\frac{180^\circ}{\pi}\right) \times rad.$$

$$degree = \left(\frac{180^\circ}{\pi}\right) \times \left(\frac{3\pi}{2}\right)$$

$$degree = 270^\circ$$

Now;

$$V = V_m \sin\theta$$

$$V = 340 \times \sin 270^\circ$$

$$V = -340$$

[illegible] ;(Assy 4)

1). Answer;

It can be possible with the overall circuit resistance may be too high. The more the resistance will be the more the ~~[illegible]~~ battery will deliver charges causing it to drain faster.

2). Answer;

For higher power electric circuits more energy is required. AC can be transmitted with much lower energy loss as compared to DC and alternating AC is easier.

3) Answer;

Some charges repels in the capacitors which slows the flow as the capacitor is charged. Where the capacitor is fully charged, the current decreases till 0.

4) Answer;

Current (I) can pass through the conductor, which generates an electric field, which cuts the uniform magnetic field, inducing current on the coil.

Question no. 2;

Solution;

By Applying KCL;

$V_1 = 10V$

$$\frac{V_2 - V_1}{2} + \frac{V_2 - V_3}{2.5} + \frac{V_2 - V}{4} = 0$$

$$\Rightarrow \frac{5V_2 - 5V_1 + 4V_2 - 4V_3 + 2.5V_2 - 2.5V}{10} = 0$$

$$\Rightarrow 11.5V_2 - 5V_1 - 4V_3 = 0 \text{ ---- eq. 1}$$

$4V = V_3$

$\Rightarrow$