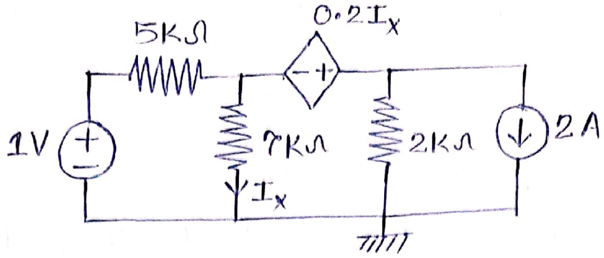
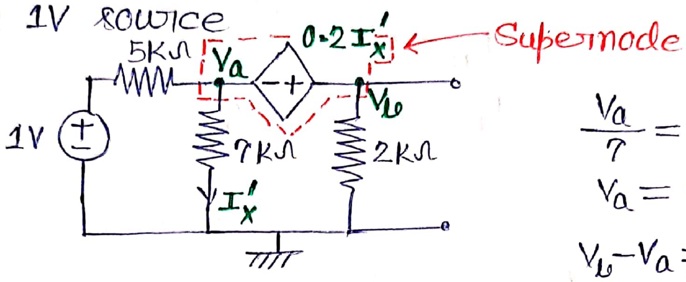
BE QUIZ-2 RUBRIC

SOL(1):



In the above N/W by applying Superposition, dependent source is replaced by neither O.C. (Open Circuit) nor S.C. (Short Circuit) & it remains same as original circuit.

Case (I): Taking 1V source



$\frac{V_a}{7} = I_x'$ —— ①

$V_a = 7I_x'$ —— ②

$V_b - V_a = 0.2I_x'$ (KVL)

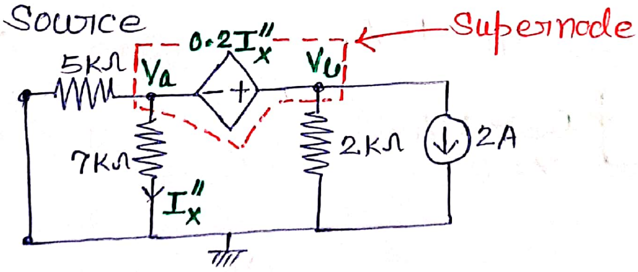
$V_b = 7.2I_x'$ —— ③

By Supernode — $\frac{V_a - 1}{5} + \frac{V_a}{7} + \frac{V_b}{2} = 0$ (KCL)

$\frac{7I_x' - 1}{5} + I_x' + 3.6I_x' = 0$

$\therefore I_x' = 0.03\, mA$ —— ④ → (2 Points)

Case (II): Taking 2A Source



$\frac{V_a}{7} = I_x''$ —— ⑤

$V_a = 7I_x''$ —— ⑥

$V_b - V_a = 0.2I_x''$ (KVL)

$V_b = 7.2I_x''$ —— ⑦

By supernode — $\frac{V_a}{5} + \frac{V_a}{7} + \frac{V_b}{2} + 2000 = 0$ (KCL)

$\frac{7I_x''}{5} + I_x'' + 3.6I_x'' = -2000$

$\therefore I_x'' = -333.33\, mA$ —— ⑧ → (2 Points)

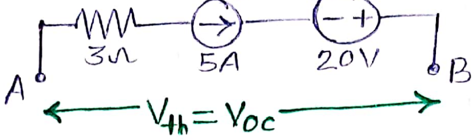
$\therefore$ By using Superposition Theorem (By eq^n ④ & eq^n ⑧),

Current $(I_x) = I_x' + I_x'' = (0.03 - 333.33)\, mA$

$= -333.30\, mA = -0.3A$ → (1 Points)

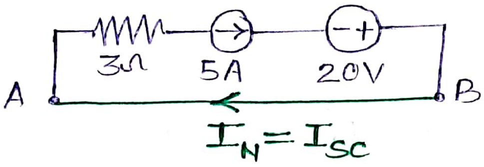
SOL(2) :-

Case(I) :- For Theverin Voltage (V_{th}) / Open Circuit Voltage (V_{oc})



In the above circuit it is not possible to find Thevenin Voltage/ Open Circuit Voltage, since it not satisfy KCL. → (1 Points)

Case (II) :- For Norton Current (I_N)/Short Circuit Current (I_{sc})

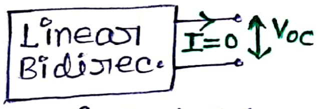


$\therefore I_N = I_{sc} = 5A$ → (1 Points)

SOL(3) :-

By given table①, we get —

Case(I) :- $V = 60$ & $I = 0$ (across 4Ω resistor)



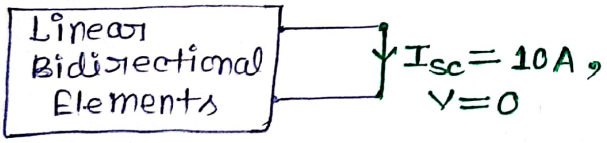
$\Downarrow$

$\therefore V_{oc} = V_{th} = 60$ Volt → (0.75 Points)

Case (II) :- $V = 0$ & $I = 10$ (across 4Ω resistor)

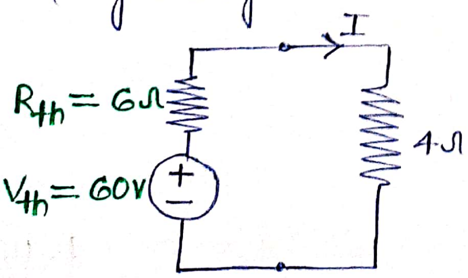
$\Downarrow$

$\therefore I_{sc} = I_N = 10A$ → (0.75 Points)



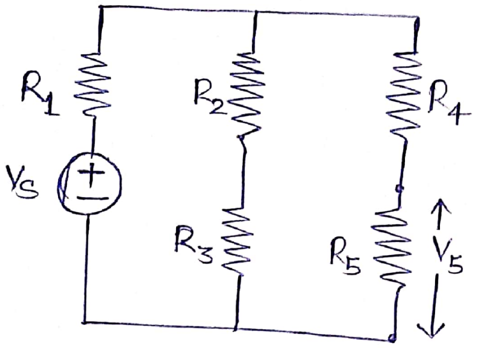
$\therefore$ Theverin Resistance $(R_{th}) = \left(\frac{V_{oc}}{I_{sc}}\right) = \left(\frac{60}{10}\right) = 6\Omega$ → (0.75 Points)

Now Linear Bidirectional Elements can be represent as (By using Thevenin's Theorems) —



$\therefore$ Current $(I) = \frac{60}{(6+4)} = 6A$ → (0.75 Points).

SOL(4) :-



The Network is having 'Linear Bidirectional Elements', hence if excitation (here independent voltage source) is multiply with constant 'K' then response of each elements (here Vol. drop across resistors) is also multiply with constant 'K'.

(Condition – to apply homogeneity principle in the network only one independent source is activated.)

Initially power in 'R_5' resistor $= P_5 = \left(\frac{V_5^2}{R_5}\right)$ —— ① → (1 Points)

After excitation (By homogeneity principle) –

∵ Source voltage (V_S) is increased by 10%. (Excitation)

∴ Voltage drop across each resistor is also increased by 10%. (Response)

∴ Power in 'R_5' resistor $= P_5' = \frac{(V_5 + 0.1V_5)^2}{R_5} = \frac{(1.1V_5)^2}{R_5} = \frac{(1.21)V_5^2}{R_5}$

∴ $P_5' = 1.21\,P_5$ —— ② → (2 Points)

∴ Percentage increase of power in 'R_5' $= \left(\frac{P_5' - P_5}{P_5}\right) \times 100$

$= 21\%$ → (2 Points)