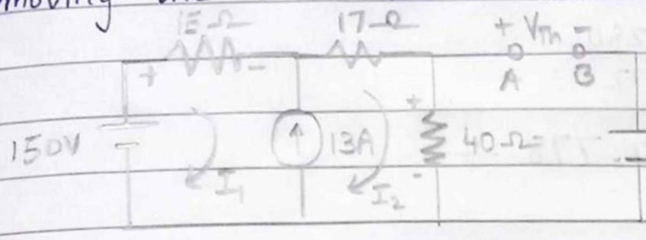
Name : Om Thanage
Roll no: 16010123217
Sign : Omthanage

Q.1] Solution: Value of $R_1 = 17\,\Omega$

Step I: Calculation of V_{Th}

Removing the $30\,\Omega$ resistor from the network,



Meshes 1 and 2 form a supermesh

Writing current equation for supermesh,

$$I_2 - I_1 = 13 \quad \dots (1)$$

Writing voltage equation for supermesh,

$$150 - 15I_1 - 17I_2 - 40I_2 = 0$$

$$\therefore \quad 15I_1 + 57I_2 = 150 \quad \dots (2)$$

Solving Eqs (1) and (2),

$$I_1 = -8.2083\,A$$

$$I_2 = 4.791667\,A$$

Writing V_{Th} equation,

$$40I_2 - V_{Th} - 50 = 0$$

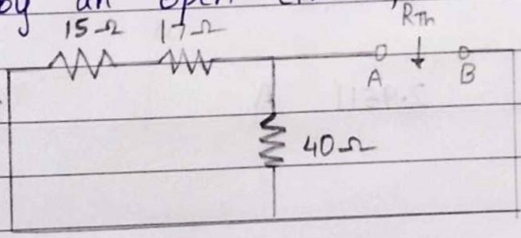
$$V_{Th} = 40I_2 - 50$$

$$= 40(4.791667) - 50$$

$$\therefore \quad \boxed{V_{Th} = 141.667\,V}$$

Step II: Calculation of R_{Th}.

Replacing the voltage sources by short circuits and the current source by an open circuit,



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$$R_{Th} = (15+17) \parallel 40$$

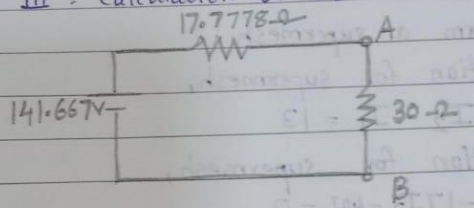
$$R_{Th} = 32 \parallel 40$$

$$= \frac{32 \times 40}{32+40}$$

$$= \frac{1280}{72}$$

$$\therefore \quad \boxed{R_{Th} = 17.7778\ \Omega}$$

Step III : Calculation of I_L

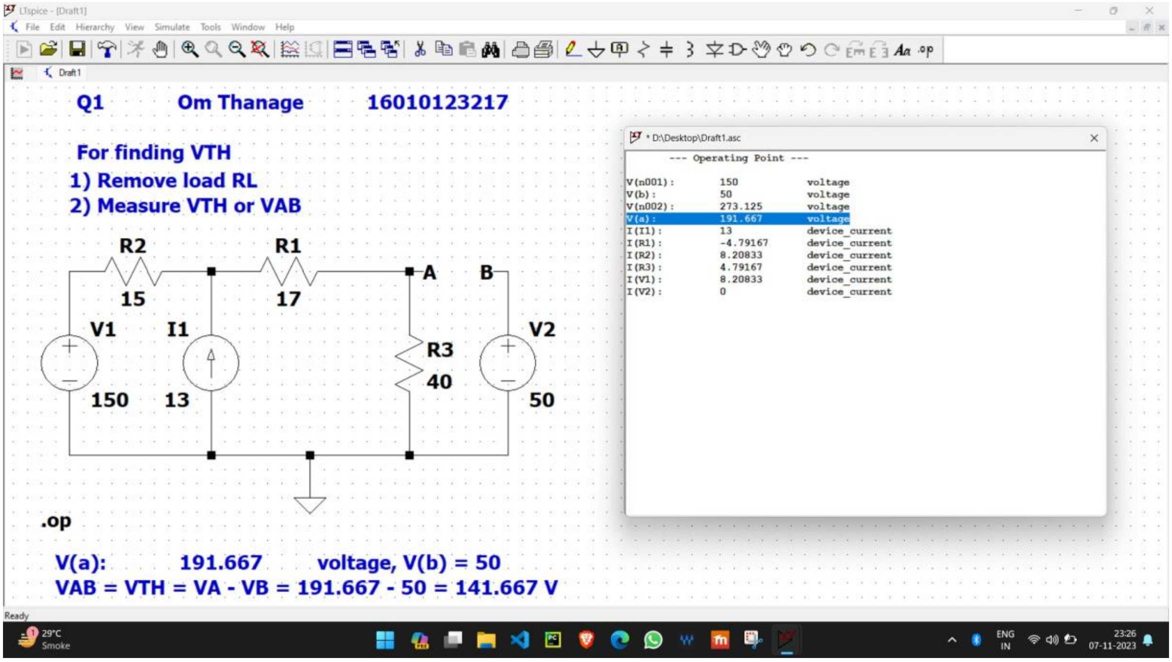


$$I_L = \frac{V_{Th}}{R_{Th}+R_L}$$

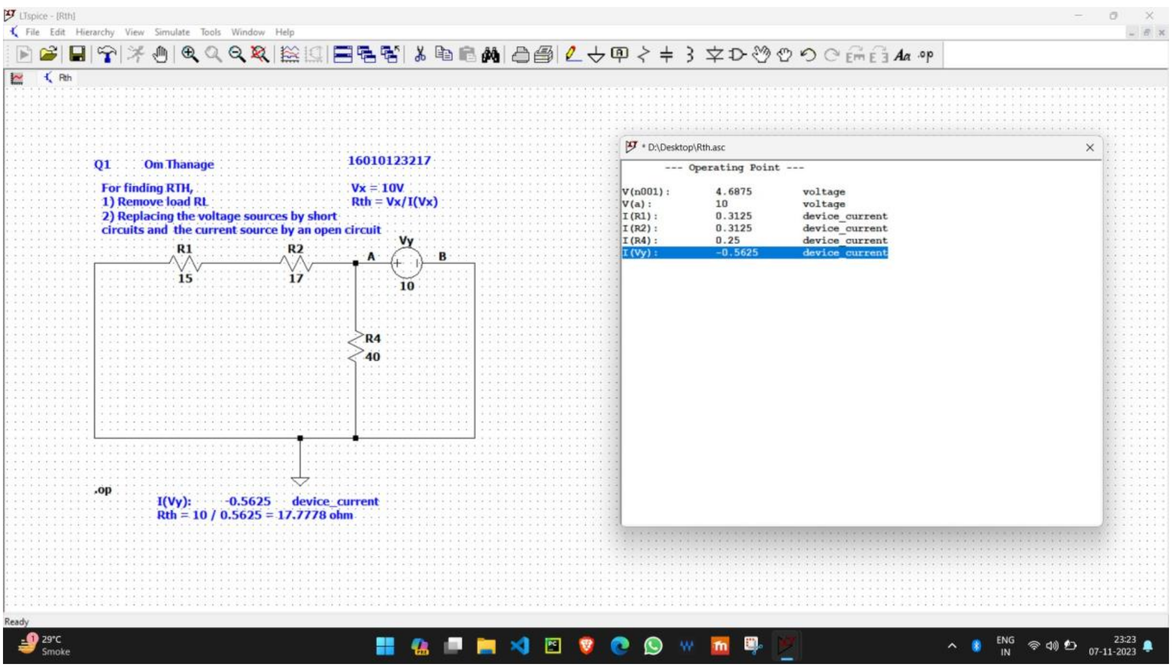
$$= \frac{141.667}{17.7778+30}$$

$$= \frac{141.667}{47.7778}$$

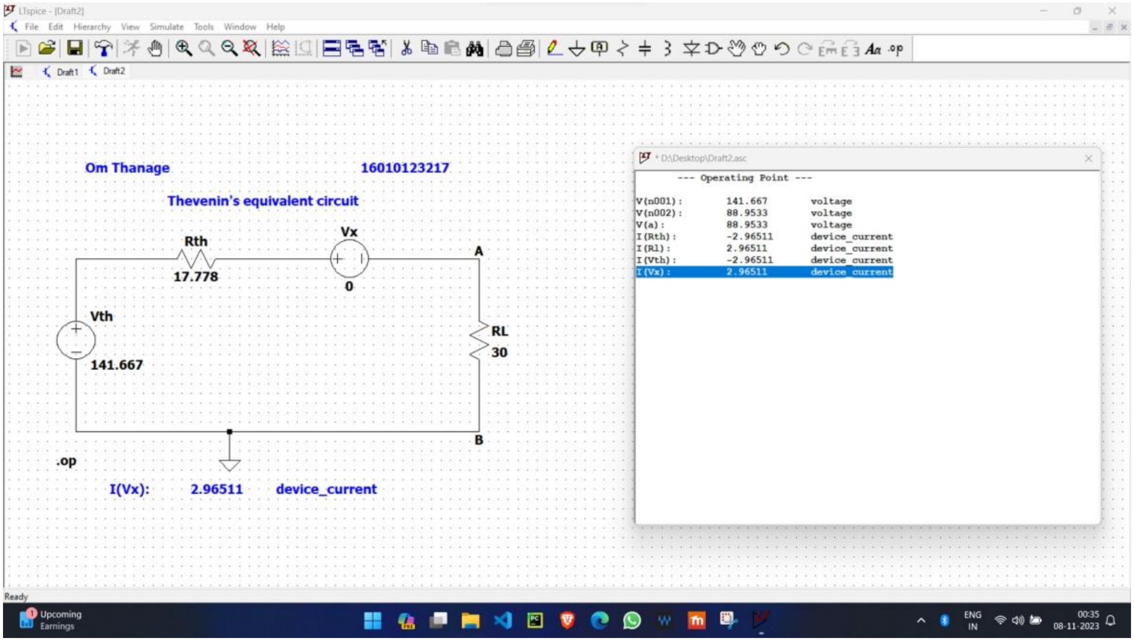
$$\therefore \quad \boxed{I_L = 2.96511\ A}$$



LTspice - [Draft1]
Q1 Om Thanage 16010123217
For finding VTH
1) Remove load RL
2) Measure VTH or VAB
R2 15
R1 17
A
B
V1 150
I1 13
R3 40
V2 50
.op
V(a): 191.667 voltage, V(b) = 50
VAB = VTH = VA - VB = 191.667 - 50 = 141.667 V
* D:\Desktop\Draft1.asc
--- Operating Point ---
V(n001): 150 voltage
V(b): 50 voltage
V(n002): 273.125 voltage
V(a): 191.667 voltage
I(I1): 13 device_current
I(R1): -4.79167 device_current
I(R2): 8.20833 device_current
I(R3): 4.79167 device_current
I(V1): 8.20833 device_current
I(V2): 0 device_current
Ready



LTspice - [Rth]
Q1 Om Thanage 16010123217
For finding RTH,
1) Remove load RL
2) Replacing the voltage sources by short circuits and the current source by an open circuit
Vx = 10V
Rth = Vx/I(Vx)
R1 15
R2 17
A
Vy 10
B
R4 40
.op
I(Vy): -0.5625 device_current
Rth = 10 / 0.5625 = 17.7778 ohm
* D:\Desktop\Rth.asc
--- Operating Point ---
V(n001): 4.6875 voltage
V(a): 10 voltage
I(R1): 0.3125 device_current
I(R2): 0.3125 device_current
I(R4): 0.25 device_current
I(Vy): -0.5625 device_current
Ready



Parameter	Theoretical value	Simulated value
Thevenin’s voltage Vth	141.667 V	141.667 V
Thevenin’s resistance Rth	17.7778 ohm	17.7778 ohm
Load current IL	2.96511 A	2.96511 A

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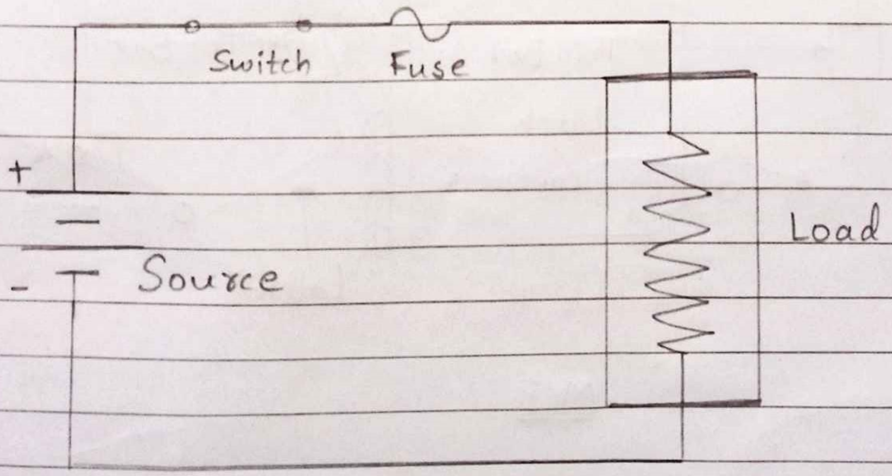
Q.3 Explain Switch Fuse unit (SFU) and MCB with a neat labelled diagram.

Ans. A Switch Fuse Unit (SFU) and a Miniature Circuit Breaker (MCB) are both electrical devices used for circuit protection, but they have different functionalities and applications.

1. Switch Fuse Unit (SFU):

It is a combination of a switch and a fuse. It is typically used for protecting electrical circuits in industrial and commerical installations. The SFU consists of a switch that can manually open or close the circuit, and a fuse that provides overcurrent position. The fuse is designed to melt and break the circuit in the event of excessive current flow, thereby protecting the connected equipment and preventing electrical hazards.

Diagram:



Switch Fuse Unit

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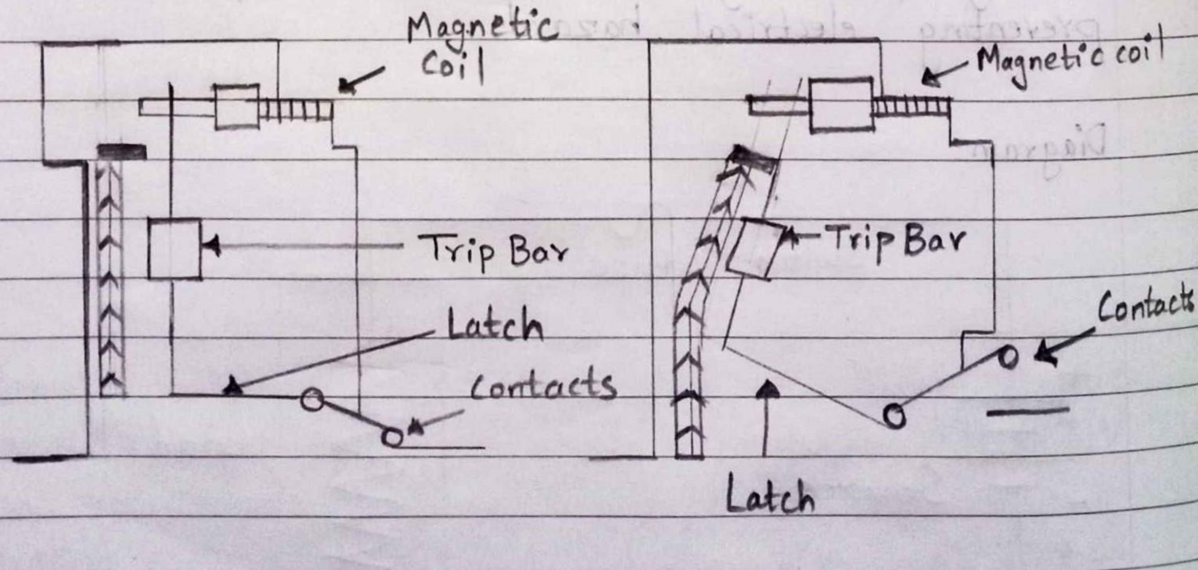
2 MCB :

Miniature Circuit Breaker (MCB) is a compact and automatic circuit protection device commonly used in residential, commercial and industrial installations. It is designed to protect electrical circuits from overcurrents and short circuits. The MCB operates based on the principle of thermal and magnetic tripping. It has a bimetallic strip that heats up when there is an overload, causing the MCB to trip and open the circuit. Additionally, it has a magnetic coil that detects high fault currents and quickly trips the MCB to disconnect the circuit.

<u>Diagram</u>:



MCB