Name

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16434

Dept.

BE(E)

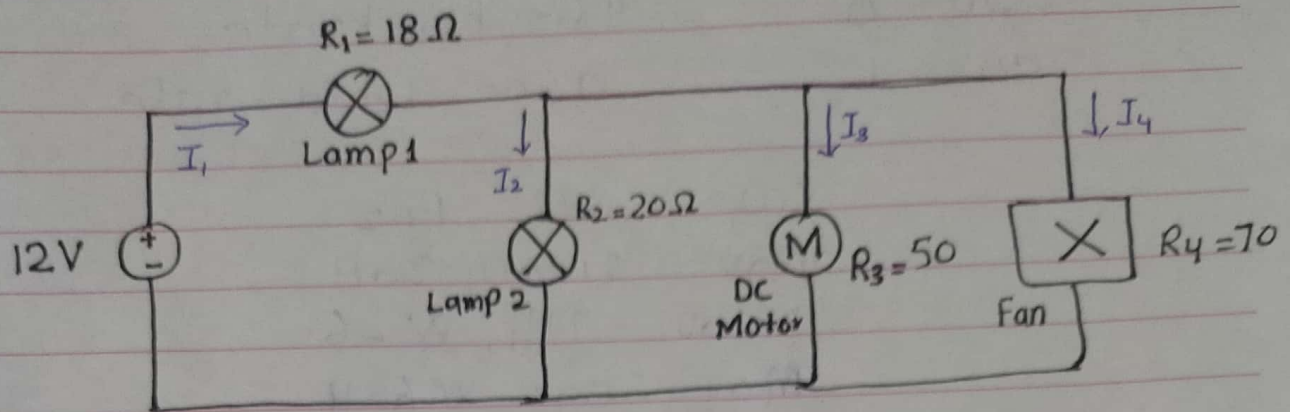Semester :-

2nd.

Assignment -

Open Ended
lab

Subject

LCA (lab)

$R_1 = 18\,\Omega$

Lamp 1, I_1, I_2, $R_2 = 20\,\Omega$, Lamp 2, 12V, I_3, I_4, M DC Motor $R_3 = 50$, X Fan $R_4 = 70$

Here R_2, R_3 and R_4 are in parallel, therefore

$$R_T = R_2 \| R_3 \| R_4 = \cfrac{1}{\dfrac{1}{R_2} + \dfrac{1}{R_3} + \dfrac{1}{R_4}}$$

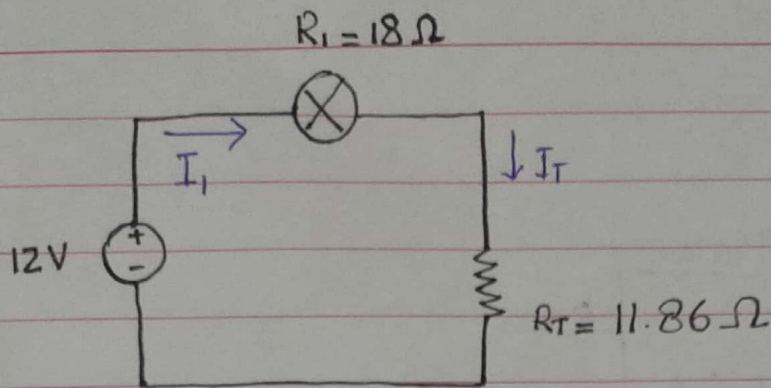$$= \cfrac{1}{\dfrac{1}{20} + \dfrac{1}{50} + \dfrac{1}{70}}$$

$$= \cfrac{1}{0.05 + 0.02 + 0.0142857}$$

$$= 11.86\,\Omega$$

Now the Circuit

$R_1 = 18\,\Omega$

I_1

$\downarrow I_T$

12V

Note

$R_T = 11.86\,\Omega$

$R_T = R_2 \| R_3 \| R_4$

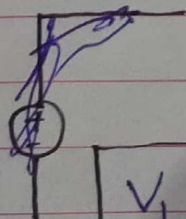Since R_1 and R_T are in Series I through both the resistance are same

∴ Current through Lamp 1 is

$$I_1 = \frac{V}{R_1 + R_T} = \frac{12}{18 + 11.86} = 0.40 \text{ A}$$

Now the circuit modifies to

Voltage across lamp V_1

$$V_1 = \left(\frac{R_1}{R_T + R_1} \right) V = \left(\frac{18}{11.86 + 18} \right) 12$$
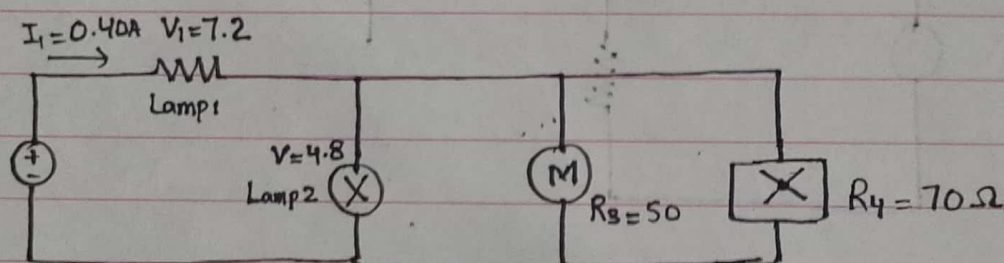
$$\boxed{V_1 = 7.2 \text{ V}}$$

Now   Voltage   across R_T

$= V - V_1$

$= 12 - 7.2$

$V_T = 4.8 V$

Now   the   Circuit   is

I₁=0.40A V₁=7.2
Lamp₁
V=4.8
Lamp2 ⊗
M R₃=50
⊗ R₄=70Ω

Since   the   voltage   across
Lamp 2   is $V_T = 4.8V$ and
R_2, R_3 and R_4 are   in   parallel
So   the   Voltage   across R_2, R_3 and
R_4 ℞ is   Same   hence

V_2 (Lamp 2) $= 4.8 V$

V_3 (MOTOR) $= 4.8 V$

V_4 (Fan) $= 4.8 V$.

Now   the   current   through

R_3 and R_4 are

$$I_2 \text{ (lamp 2)} = \frac{4.8}{20} = 0.24 \text{ A}$$

$$I_3 \text{ (Motor)} = \frac{4.8}{50} = 0.096 \text{ A}$$

$$I_4 \text{ (Fan)} = \frac{4.8}{70} = 0.068 \text{ A}$$

c) Now   For   Power   losses

Power   loss   in   Lamp 1 = P_1 = $V_1 I_1$

$$= 7.2 \times 0.40$$

$$= 2.88 \text{ W}$$

Power   loss   in   Lamp 2 = P_2 = $V_T I_2$

$$= 4.8 \times 0.24$$

$$= 1.152$$

Power   Loss   in   Motor = P_3 = $V_T \times I_3$

$$= 4.8 \times 0.096$$

$$= 0.4608 \text{ W}$$

Power Loss in DC Fan = $P_4 = V_T \times I_4$

$= 4.8 \times 0.068$

$= 0.3264$ W

The final Circuit is

$I_1 = 0.40A \quad R_1 = 18\Omega$

$V_1 = 7.2$
$P_1 = 2.88W$

$\downarrow I_2 = 0.24$

$\downarrow I_3 = 0.096$

$\downarrow I_4 = 0.068$

12V

$V_2 = 4.8V$ ⟩ $R_2 = 20$

$P_2 = 1.152$

(M) $V_3 = 4.8V$
$R_3 = 50$

$P_3 = 0.4608$

[X] $V_4 = 4.8V$
$R_4 = 70$

$P_4 = 0.3264$

PR1 v 12.000V

1

2

PR2 v 4.7673V

PR3 v 4.7673V

PR4 v 4.7673V

18.0Ω

V1

12V

R2

20.0Ω

R3

50.0Ω

R4

70.0Ω

0

PR4 _I_ 401.82mA

A 1

2

PR2 **A** _I_ 238.37mA

PR3 **A** _I_ 95.346mA

PR1 **A** _I_ 68.104mA

18.0Ω

V1

12V

R2

20.0Ω

R3

50.0Ω

0

R4

70.0Ω