Abdul Aziz ID# 13741 BEE

Q1

Ans Given data:

Two voltmeters range = 0 - 300V

$R_1 = 25\,K\Omega$

$R_2 = 15\,K\Omega$

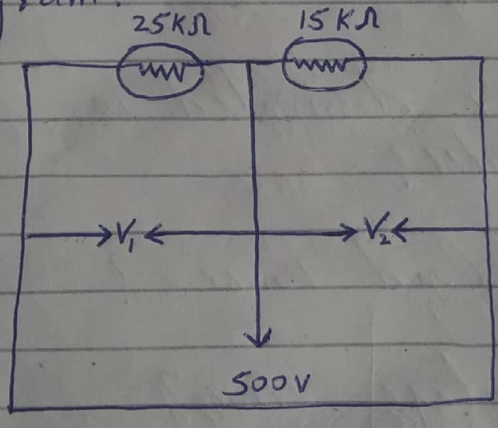
Total voltage VI = 500V

Required

Voltage reading in 1st voltmeter = ?

" " " 2nd voltmeter = V_2 = ?

Diagram:-



Solution:

Here we use voltage divider rule the reading of the voltmeter are.

$$V_1 = \frac{25K\Omega}{25K\Omega + 15K\Omega} \times 500V$$

$$V_1 = 312.5V$$

$$V_2 = \frac{15K\Omega}{15K\Omega + 25K\Omega} \times 500$$

$$V_2 = 187.5V$$

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Q = 2

Ans

Given data:-

$R_1 = 0.5\Omega$

$R_2 = 0.5\Omega$

Power = P = 200W

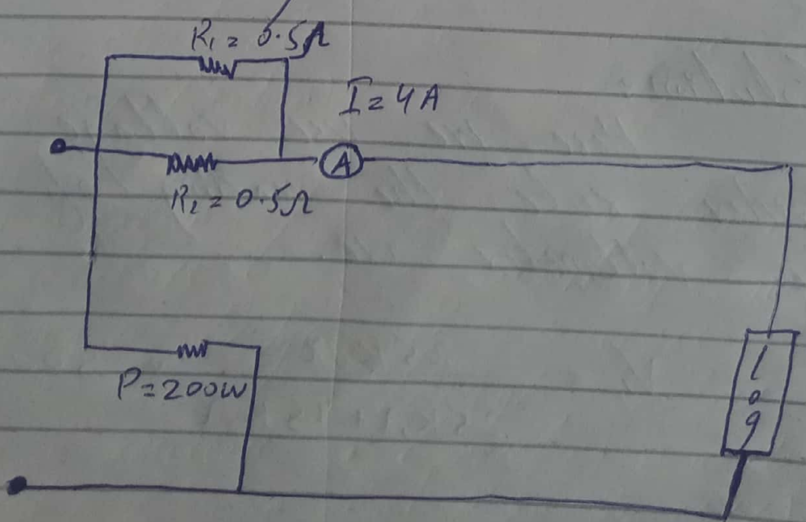
I = 4A

Required:

(a) Power dissipated in the voltmeter?

(b) True Load Power = ?

(c) Percentage error = ?



solution:

Resistance of current coils

$$R_c = \frac{R_1 R_2}{R_1 + R_2}$$

$$R_c = \frac{0.5 \times 0.5}{0.5 + 0.5}$$

$$R_c = \frac{0.25}{1} = 0.25\,\Omega$$

(a)

$$I^2 R_c = ((4)^2 \times 0.25)$$

$$= 16 \times 0.25$$

$$I^2 R_c = 4\,w$$

(b) True load power = 200 - 4

= 196 w

(c)

$$\%\ error = \frac{P - True\ load}{True\ load\ power} \times 100$$

$$= \frac{200 - 196}{196} \times 100$$

% error = 2.0408.

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Question No # 3 (a)

⇒ Wheatstone Bridge:

The Wheatstone bridge was invented by Samuel Hunter Christie in 1833 and improved by sir Charles Wheatstone in 1843.

⇒ Kelvin's Bridge:

Also known as double bridge and in some countries a thomson bridge, is a measuring instrument used to measure unknown electrical resistance.

Wheatstone Bridge	Kelvin Bridge
• Used to measure unknown electrical resistance. (Medium)	Used to measure low resistance very accurately.
• Combination of 4 resistors forming a bridge	When implementing in laboratory, connect all resistors through wires
• Unknown resistors connected to 2 known resistors and Galvanometer	• Connecting wire b/w Point m & n having (r). Galvanometer connect to Point M & n.

Question # 3 (b)

In the bridge Configuration, we can apply the KVL in two loops.
the upper (R_1 - R_2 null indicator) and lower (R_2 - R_4 null indicator)

It is more convinient to apply KVL in upper loop (left R - Right R_3 - OP-amp input).

Reasoning as follows.

For example. If an input is connected at the inverting input. It sinks current from op-amp output through the right resistor (R). and a voltage drop

$$V_R = I * R$$

Appears accross this resistors. The op-amp reach to this intervention by passing the same current through left. resistor R and external load.

Thus producing the same voltage drop

$$V_R = I * R$$

As a result. The difference b/w two voltage drops, applied to op-amp differential input is almost zero.

So we consider only the upper loop without minding what is in lower loop.

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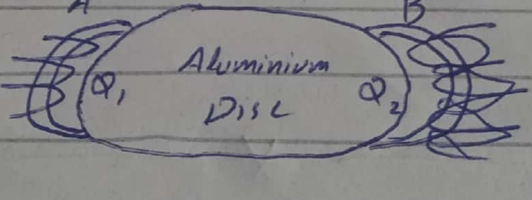
Q No# 4 (a)

⇒ Energy Meter:-
It is an instrument which measures the electrical energy.
Since the electrical energy consumed by a load adds up as the time goes on. It is evident that watt hour meter is an integrity type instrument.
It should be noted that the energy meter designed for DC circuits can be used on AC circuits but the reverse is not true.

Induction Principle



Above figure shows the working principle of induction type energy meters.

Part (b)

⇒ When $Q = 0°$ (i.e the two fluxes are in phase) then defecting torque is zero.

⇒ The deflect torque will be maxium when $Q = 90$ i.e the flux has a phase difference of $90°$.

⇒ The deflecting torque is same of every instant since Q_m, Q, m & Q are fixed for a given condition.

⇒ The direction of deflecting torque depends upont which flux is leading the other.

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QNo (5) (a)

Anss The series magnetic is wend with a wire of few axis connected in series with load so that it carries the load current. The coil of this magnetic is highly non-inductive.

(b)

Ans:-

Meter Constant:

$N \propto$ energy

$N = K \times$ energy

Where K is constant called meter constant.

∴ Meter constant = K = N/energy

$$= \frac{\text{No of revolution}}{\text{Kwh}}$$

Hence the no of revolutions made by the disc for 1 Kwh of energy consumption is called meter constant.

For example:

if meter constant of energy meter is 1500 rev/kwh. it means that for consumption of 1 kWh the disc will make 1500 revolution.

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