Ayub.

Department of Electrical Engineering
Assignment
Date: 23/06/2020

Course Details

Course Title: Instrumentation and Measurement
Instructor: Waleed Jan
Module: 6th (BE)
Total Marks: 50

Student Details

Name: Hafiz Ayub Hassan **Student ID:** 6997

Note: Draw neat diagrams where necessary. Assume missing details if required.

Q1.		A student has connected two voltmeters in series and have applied 500V across them. Both voltmeters have the same range of 0-300V. What will be their readings if their internal resistances are 25kΩ and 15 kΩ respectively?	**Marks 10** **CLO 2**
Q2.		A dynamometer type wattmeter has two current coils each having a resistance of 0.5Ω. Both of the coils are connected in parallel. The wattmeter voltage coil is connected to the supply side. The wattmeter shows a reading of 200W while the reading on the ammeter is 4A which is connected in series with the current coil of the wattmeter. Calculate the following parameters: a) Power dissipated in the wattmeter b) True load power c) Percentage error due to the connection of wattmeter	**Marks 10** **CLO 2**
Q3.	**(a)**	What is the difference between Kelvin's bridge and Wheatstone Bridge? Explain briefly.	**Marks 05** **CLO 3**
	(b)	Explain how the potential on the upper (top) node in a DC bridge is equal to the potential on the lower (bottom) node?	**Marks 05** **CLO 3**

Q4.	(a)	Why the energy meters designed for DC circuits cannot be used for AC circuits?	Marks 05 CLO 03
	(b)	What will happen if the phase difference between two alternating fluxes in an induction type energy meter is zero degrees?	Marks 05 CLO 03
Q5.	(c)	Why the series magnet is wound with a wire of few turns as compared to shunt magnet in an induction type energy meter?	Marks 05 CLO 03
	(d)	What is the significance of meter constant in an energy meter?	Marks 05 CLO 03

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Q No: 1

A Student has Connected two voltmeters in Series and have ..... resistances are 25KΩ and 15KΩ Respectively. ?

Sol:

Given:

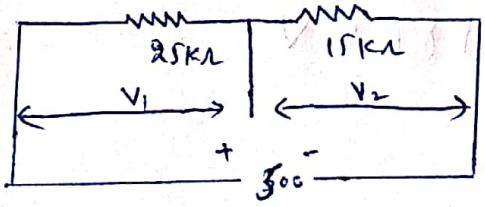
$V = 500V$ Range = 0-300V

$R_1 = 25K\Omega$ $R_2 = 15K\Omega$

Required:

$V_1 = ?$ $V_2 = ?$

Solution:



The figure show the conditions of The Problem. Hence by voltage divider Rule, The readings of the two voltmeter are:

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

$$V_1 = \frac{25K\Omega}{40K\Omega} \times 500$$

$$V_1 = 312.5\ V$$

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

$$V_2 = \frac{15K\Omega}{40K\Omega} \times 500$$

$$V_2 = 187.5\ V$$

X ——————————— X

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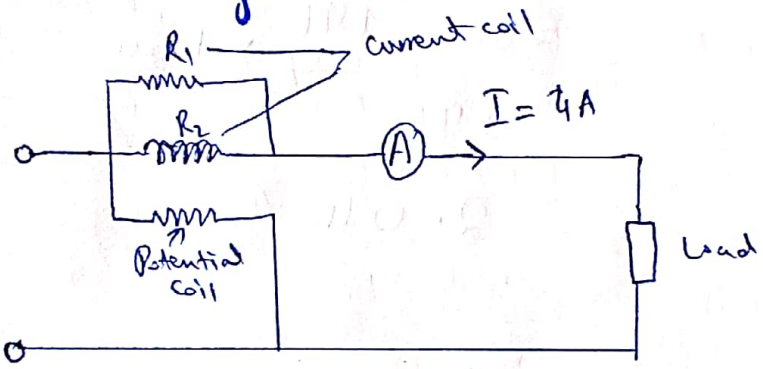
Q No: 2

A dynamometer Type wattmeter has two current coils each having a Resistance of 0.5Ω ..... calculate:

(a) Power dissipated in the wattmeter

(b) True Load Power

(c) Percentage error...



Sol: Effective resistance of the current Coil :

$$R_c = \frac{R_1 R_2}{R_1 + R_2} = \frac{0.5 \times 0.5}{0.5 + 0.5} \Rightarrow 0.25\Omega$$

(i) Power dissipated in the wattesMeter $= I^2 R_c$

$$= I^2 R_c \Rightarrow (4)^2 (0.25) \Rightarrow 4 \text{ watt}$$

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(2) True Load Power:

$$= 200 - 4$$

$$= 196\ W$$

(3) Percentage error:

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

$$= 2.04\ \%$$

x ——————————— x

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Q3 part(a)

What is the difference between kelvin,s bridge and wheatstone bridge? explain.

Wheatstone bridge:

The wheatstone bridge was Invented by Samuel Hunter Christie in 1833 and Improved by Sir Charles Wheatstone in 1843.

kelvin,s bridge:

A kelvin bridge also known as kelvin double bridge and in some countries a Thomson bridge, is a Measuring Instrument Used To Measure Unknown Electrical Resistors.

Difference:

Wheatstone bridge	kelvin bridge
1: It is Used to Measure an Unknown electical resistance (Medium size)	It is Used To Measure low resistance very occurately.

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Wheatstone bridge

2: The wheatstone bridge is the combination of 4 Resistors (Resistances) forming a bridge.

3: The Unknown Resistors are connected to 2 known resistors and Galvanometer.

Kelvin's bridge.

When we are implementing a kelvin bridge in Laborty we connect all the Resistors through wires.

In kelvin bridge, we have a connecting wire b/w point m & n having a resistance (r) a.
The Galvanometer can connect both to point m & n.

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Q No: 3 (b)

Explain how the potential on the upper (Top) node in a Dc bridge is equal ..... lower node. ?

Ans: In the bridge Configuration we can apply KVL. In Two Loops. The upper (R_1 R_3 - Null Indicator) and lower (R_2 - R_4 - Null Indicator).

In Dc bridge it is More easy To apply KVL on the upper loop. The result, the Difference b/w the two voltage drops applied to the Op-amp differential input is almost Zero - So we Consider Only the upper loop without mind What is included in the lower loop. we no net even Portrayed it.

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Q No: 4 (a)

Why the energy meters designed for Dc circuits cannot be Used for Ac circuits.?

Ans: Energy Meters designed for Dc circuits Cannot be Used for Ac circuits because Ac Energy Meters works due to the Involvement of two alternating Magnetic fields produced by Ac Quantities (Voltage and Current Respectively) that Interacts with an aluminium disk causing eddy Current to Induced in the disk. Due To this eddy current and pre-existing Magnetic disk experience a force which Causes it to rotate and Increament the reading in the Proportion to the amount of energy Consumed.

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In Dc Induction effect and eddy current are nor Produced so the Same energy Meter cannot measure the energy Consumed by any Dc circuit Until Unless you Convert the Dc to Ac then put it through the Energy Meter and again convert it to Dc and then Supply to the Dc load.

X ——————————— X

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Part 1(b)

What will happen if the Phase difference between ---------- zero degrees?

Ans: ⇒ It should be noted when two $\theta = 0°$ (i.e the two fluxes are in Phase) then deflecting torque is zero.

The deflecting Torque will be

⇒ Maximum when $\theta = 90°$. ie when the alternating flux has a Phase differece of 90°.

⇒ The deflecting torque is the same as every instant since ϕ_{1m}, ϕ_{2m}, and θ are fixed for a given Condition.

⇒ The direction of deflecting Torque depends upon which flux is leading the other.

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Q No: 5 (a)

Why the series Magnet is wound with .... - - — — - - —?

Ans: Series Magnet:

It Consists of a number of U-Shaped laminations of silicon steel together to form a core. A coil of thick wire having a few Turns is wounded in both legs of U-shaped Magnet. The coil is known is current coil which is Considered Connected series with load. Produce the Magnetic field proportional and in Phase with line current I.

X ——————————— X

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Q No: 5 (d)

What is the Significance of Meter Constant in an energy Meter.?

Ans: Meter Constant:

$N \propto$ Energy.

$N = k \times$ energy.

Where k = is a Constant called Meter Constant.

Meter Constant $k = \frac{N}{\text{energy}} = \frac{\text{No. of Revolutions}}{\text{kWh}}$.

⇒ The Constant is shown on the Meter nameplate. A Constant "kh=7.2" Means that for each Revolution of the disk 7.2 ~~what~~ watt-hours has been Used (constants will vary with different Meters).

X ——— The end. ——— X