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

Course Details

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

Student Details

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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)

Sol:- Given data:-

$V = 500\ V$ range $= 0 - 300\ V$

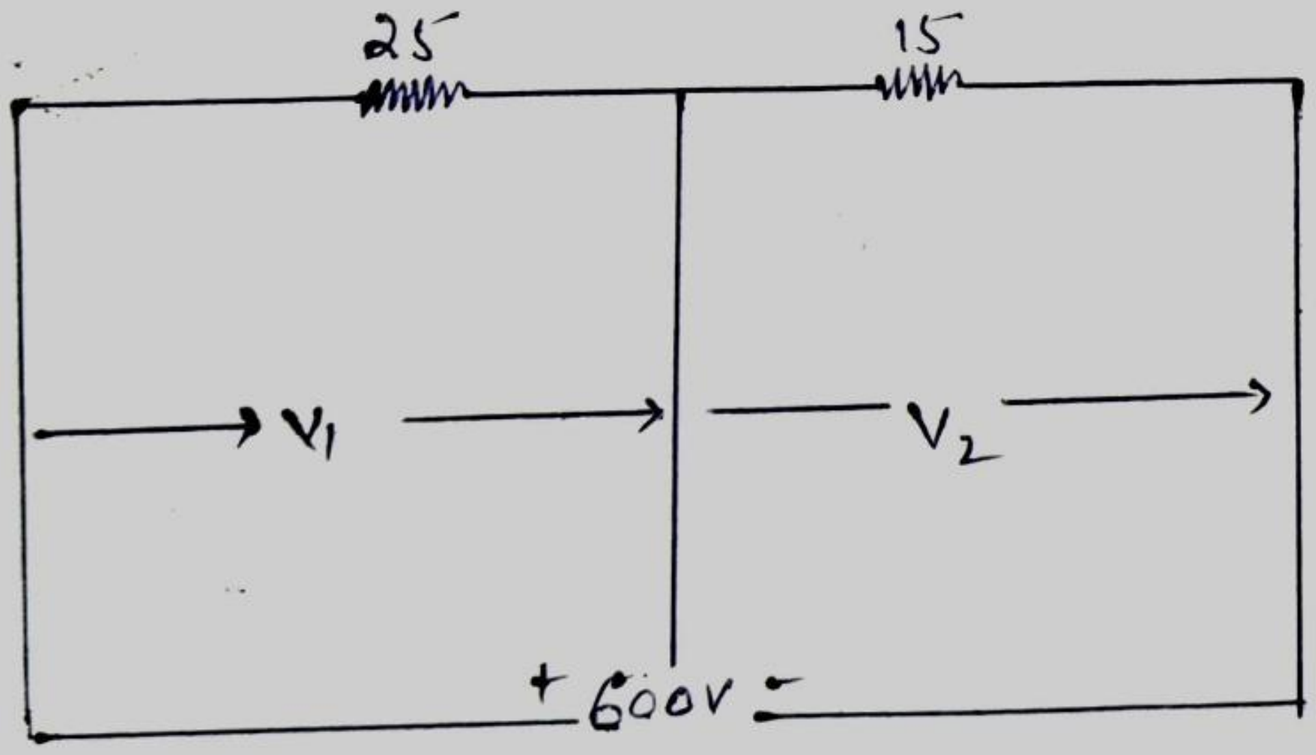
$R_1 = 25\ K\Omega$ $R_2 = 15\ K\Omega$.

Required:- $V_1 = ?$ $V_2 = ?$

~~i) Power dissipated in the wattmeter~~ ?

~~ii) True load power~~.

~~iii) Percentage error~~.



i) $V_1 = \frac{R_1}{R_1+R_2} \times V = \frac{25K\Omega}{25K+15K\Omega} \times 500$

$V_1 = 312.5\ V$

$$V_2 = \frac{R_2}{R_2 + R_1} \times 500 = \frac{15K\Omega}{15K + 25K\Omega} \times 500$$

$$V_2 = 187.5\ V$$

Q No 2:

Sol:- Given data:-

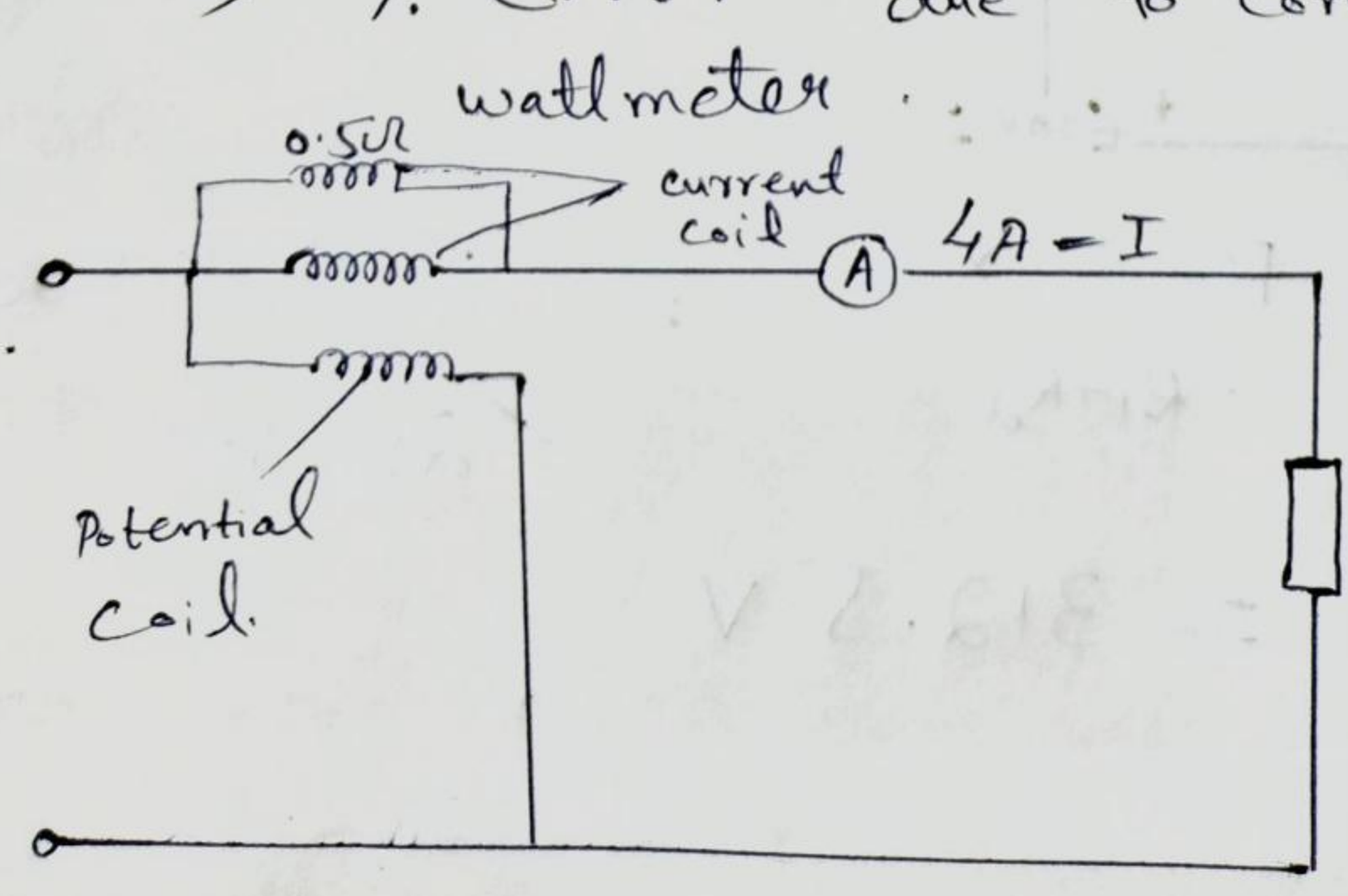
$R = 0.5\ \Omega$ $P = 200\ W$

$I = 4\ A$.

Required:-

i) Power dissipated in the wattmeter
ii) True load power.
iii) % error due to connection of wattmeter.

Sol:-



$$R_c = R_1 R_2 / R_1 + R_2 = \frac{0.5^- \times 0.5}{0.5^- + 0.5^-} = 0.25^- \Omega$$

i) Power loss in the wattmeter $= I^2 R_c$

$= (4)^2 (0.25^-)$

$= 16 (0.25^-)$

$= 4W$

ii) True load Power $= 200 - 4 = 196W$.

iii) % error $= 200 - 196 / 196 \times 100 = 2.04\%$

Q No 3 (a)

Answer:- Difference b/w Kelvin bridge and Wheatstone bridge.

i) Kelvin bridge:- The Kelvin bridge is more advance and helps in measuring resistance less then 1 ohm. However it has two more

resistors then the wheatstone bridge.

ii) Wheatstone bridge :- The wheat stone bridge was invented by Samuel Hunter christie in 1833. A wheatstone bridge measure electrical resistance by balancing a bridge circuits. The circuit has two legs of which one contains the unknown resistance of value between 1 ohm to 10 ohm. A part from resistance, This setup can also measure impedence, capacitance and inductance.

Q.No 3(b) The port is known as balance condition. when $I_3 = 0$ A The condition is called balanced condition.

$$V_{BD} = V_B - V_D = I_3 G_1 \Rightarrow V_{BD} = I_3 G_1$$

$$V_{BD} = I_3 G_1 \Rightarrow V_{BD} = 0\,(G_1)$$

$$V_{BD} = 0V \Rightarrow 0Y \quad V_B - V_D = 0$$

$$V_B = V_D .$$

Now putting in eq ① & ②

① $\Rightarrow$ $V_{AB} = V_A - V_D = I_1 P$ new eq — ①

$V_{BC} = V_D - V_D = I_1 Q$ — new eq ②

Now new eq① with eq ③

$= I_1 P = I_2 R$ or $I_1/I_2 = R/P$ — ⑤

compare eq ② with eq ④

$I_2 X = I_1 Q$ or $I_1/I_2 = X/Q$ — ⑥

So compare ⑤ & ⑥

$R/P = X/Q$ or $X = (R/P)Q$.

Q No 4 (a)

Answer:- Energy meter designed for Dc circuits not Ac because Ac energy works due to involvement of two alternating magnetic fields produced by Ac quantities (voltag and current) that interacts with an aluminium disk causing eddy current to induced in the disk.
In Dc such induction effect and eddy current nor produced.

Q No 4 (b)

It should be noted that when $\varphi = 0^\circ$ (i.e two fluxes are in phase) then deflecting torque is zero. or no torque can be produced.
Torque will be maximum when $\varphi = 90^\circ$.

QNO 5 (a)

Answer:- The Series magnetic is wound with a wire of few turns asis Connected in Series with load so that It carries the load current. The coil of this magnetic is highly non-inductive.

QNO 5 (b) Meter constant :-

$N \propto$ Energy .

$N = K \times$ energy.

where K is constant called meter constant.

$\therefore$ Meter Constant $K = N / \text{Energy} = \frac{\text{No. of revolution}}{\text{Kwh}}$.

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.