Department of Electrical Engineering
Assignment
Date: 20/04/2020

Course Details

Course Title: Instrumentation and Measurement
Instructor: SIR WALEED
Module: 6th (BE)
Total Marks: 30

Student Details

Name: RIMSHA KHAN
Student ID: 13672

Q1.	(a)	A student mistakenly connects an ammeter in parallel in a circuit. What will happen? Explain briefly.	Marks 05 CLO 2
	(b)	A student mistakenly connects a voltmeter in series in a circuit. What will happen? Explain briefly.	Marks 05 CLO 2
Q2.	(a)	Random error cannot be easily reduced in measurements. Justify this statement.	Marks 05 CLO 1
	(b)	What are the different reasons due to which gross error occurs in measurement? Explain briefly.	Marks 05 CLO 1
Q3.	(a)	What will happen if a spring in not connected with the coil of a moving coil galvanometer? Explain briefly.	Marks 05 CLO 2
	(b)	A student is performing an experiment in the laboratory during which he finds out that the measuring instrument is giving a Full Scale Deflection for a current of 10 μ A. He wants to measure a voltage of 20V with the help of this measuring instrument. Now, What should be the appropriate value of the resistor to be added with this instrument so that it can measure up to 20V? Moreover, should the resistor be connected in series or parallel with this instrument?	Marks 05 CLO 02

NAME :- RIMSHA KHAN
I.D :- 13672

QUESTION 1 :-

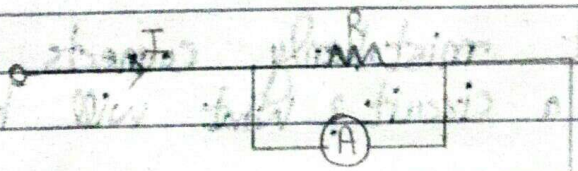
PART A :-

Q A student mistenly connects an ammetes in pasallel in a ciscuit? What will happen? Explain bsiefly?

Ammetes :-

An ammetes is an instsument used to measuse cussent.

If we connect ammetes in pasallel :-



An ideal ammetes has zeso sesistance. On the othes hand a non-ideal ammetes has vesy small sesistance. When we connect an ammetes in pasallel So as we know that cussent always flows in low sesistance path, maximum amount of cussent will flow thsough the ammetes which in tusn will busn the fuse os can damage the ammetes.

If we connect an ammetes in pasallel then these ase two psoblems.

1, The fisst is that you haven't put the ammetes in the way of the cussent you ase

trying to measure. So you can't be measuring it properly.

2, The second is that the current drawn increases. So you are changing the current you are trying to measure. A low resistance in parallel with a high resistance has an effective resistance of a little less than the low resistance.

So, the low resistance ammeter makes the effective resistance of the circuit very low and so the current is very big. The ammeter actually shorts out and this can damage the ammeter because a very big current flows in it.

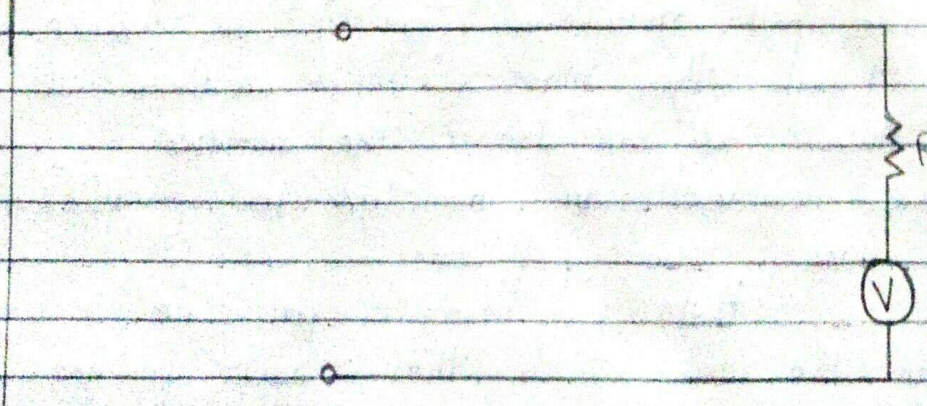
PART 2 :-

Q A student mistakenly connects a voltmeter in series in a circuit? What will happen? Explain briefly?

Voltmeter :-

A voltmeter is an instrument or a device which we used to measure voltage.

If we connect voltmeter in series :-



An ideal voltmeter have infinite resistance so it is clear that it will block the current. An ideal voltmeter draws 0 current from the circuit.

So when we arrange it in series is doesn't work as a voltmeter but as a resistance and also the reading shown by the voltmeter is the voltage across its terminals.

Now if we connect a voltmeter in series the problem occurs is.

If you break a circuit and insert a voltmeter than you are introducing a big resistance in to the circuit and so the current is small everywhere. This means the bulb in a circuit will be out, which means you are not measuring the voltage across a bulb, when its lit.

So for these reasons voltmeter should always be connected in parallel not in series.

QUESTION 2.:

PART A:-

Q Random errors cannot be reduced in measurements. Justify this statement?

Random errors:-

"An error in measurement caused by factors which vary from one measurement to another"

Random errors are statistical fluctuations in the measured data due to the precision limitations of the measurement device. Random errors usually result from the experimenter inability to take the same measurement in exactly the same

way to get exact the same number.

Random errors cannot be reduced in measurements :-

If you take multiple measurements the values cluster around the true value. Thus random error primarily effects precision. Now if we look at the following examples you will know that random errors always occur.

1, When weighing yourself on a scale, you position yourself slightly differently each time.
2, When taking a volume reading in a flask, you may read the value from a different angle each time.
3, Measuring the mass of a sample on an analytical balance may produce different values as air currents affect the balance or as water enters and leaves the specimen.
4, Readings must be estimated when they fall between marks on a scale or when the thickness of a measurement marketing is taken in to account.

So its means that in different values random error sometimes increase and sometimes decrease. Everytime it gives different values. Random error always occur and cannot be predicated and thats why it cannot be reduced in measurements.

Examples :-

Random errors caused by :-

1, Electronic noise in the circuit of an electrical instrument.
2, Irregular changes in the heat loss rate from a solar collector due to changes in the wind.

PART B :-

Q What are the different reasons due to which gross error occurs in measurement? Explain briefly?

Gross error :-

Gross errors are caused by experimenter carelessness or equipment failure. This type of error occurs due to human negligency.

Reasons due to gross error occurs :-

1, Doing mistakes in using instruments or meters.
2, Doing mistake in calculating or recording data results.
3, Bad habit of persons not properly remembering data or results.
4, Not taking proper result from, reading, writing and calculating.
5, At later time, presenting wrong data.
6, When equipment gives wrong result.

Examples :-

1, A person reading pressure guage 1.01 N/m² as 1.10 N/m². It may be due to the persons bad habit of not properly remembering data at the time of taking out reading.
2, Reading of the instrument value before it reaches steady state.
3, Calculating a derived measurement wrongly like a person calculating resistance from voltmeter and ammeter values. So if he has done some wrong division then the value of resistance will be wrong.

Careful reading of data can reduce gross error.

QUESTION 3 :-

PART A :-

Q What will happen if a Spring is not connected with the coil of a moving coil galvanometer? Explain briefly?

Galvanometer :-

A galvanometer is a type of sensitive ammeter; an instrument for detecting small electric current. It is an analog electromechanical actuator that produces a rotary deflection of some type of pointer in response to electric current through its coil in a magnetic field.

If Spring is not connected with the coil of a moving coil galvanometer :-

When we give supply to the galvanometer coil so due to magnetic field the galvanometer coil produced deflecting torque and the spring present at another end of the coil produced restoring torque.

The restoring torque is required to bring the galvanometer pointer back to the original position after removal of supply.

If Spring is not connected with a moving coil galvanometer, the galvanometer coil only deflecting torque will produced and due to absence of restoring torque the pointer of galvanometer will not come to its starting position after removal of supply.

PART B :-

Q A student performing an experiment in laboratory during which he finds out that the measuring instrument giving a full scale deflection for a current of 10 uA. He wants to measure voltage of 20 V with the help of this measuring instrument. Now what should be the appropriate value of the resistor to be added with this instrument so that it can be measure up 20 V? Moreover, should the resistor be connected in series or parallel with this instrument?

Sol:- Given data :-

$$V = 20\ V$$
$$I_g = 10\ \mu A \Rightarrow 10 \times 10^{-6}\ A$$

We are neglecting "G".

So,

$$G = 0\ \Omega$$

Required :-

$$R = ?$$

Formula + Solution :-

$$V = i_g (G + R)$$
$$\frac{V}{i_g} = G + R$$

Now we have to find R.

So,

$$R = \frac{V}{i_g} - G$$

putting values

$$R = \frac{20}{10 \times 10^{-6}} - \Omega$$

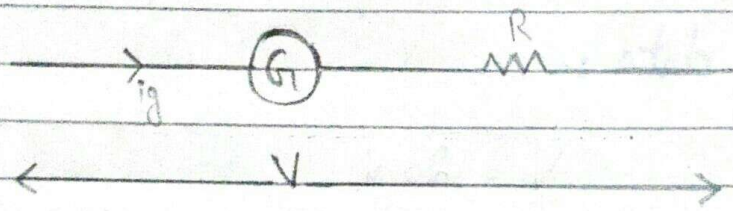
$$R = 2 \times 10^{6}$$

So

$$\boxed{R = 2M\Omega}$$

Connection:-

In this experiment resistor is connected in series with the instrument.



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