

Ayub

Department of Electrical Engineering

Assignment

Date: 20/04/2020

Course Details

Course Title: Instrumentation and Measurement

Module: 6th (BE)

Instructor: Sir Waleed Jan

Total Marks: 30

Student Details

Name: Hafiz Ayub Hassan

Student ID: 6997

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 is 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 $10 \mu A$. 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

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Question NO: 1

Part (a): Ammeter in Parallel in a circuit?

Ans: An Ammeter is used to measure current in a circuit and current remains constant in series circuit. If Ammeter is connected in parallel than because of its low Resistance large amount of current will flow through it instead of the original circuit.

Explanation:

Since the Ammeter is a low Impedance device, connecting it in a parallel with the circuit would cause a short circuit, damaging the Ammeter or the circuit, It should be connected in series so that Maximum current can pass through it, for accurate measurement of current (I).

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more over its resistance is very low if it is connected in parallel in a circuit, it will be the current and current can not be measured accurately - If you do not connect the ammeter in series you will shunt the load, basically excluding the resistive element of the circuit.



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Question No: 1

Part (b) : Voltmeter connects in series in a circuit, explain.

Ans: A voltmeter measures the potential difference across two points in a circuit - In parallel connection the voltage in the branches remains same and the resistance of the voltmeter is very high so very less amount of current flows through it and thus it doesn't disturb the original circuit.

Explanation:

If it is connected in series then it will just measure the potential difference between two points of a single strand of wire which is obviously zero - Hence voltmeter is connected in parallel to measure voltage -

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The Problem with Connecting a Voltmeter in Series:

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



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Question No: 2

a) Random error cannot be easily reduced in measurements. justify this statement.

Ans: A Random error makes the measured value both smaller and larger than the true value, they are errors of precision. Random errors occur by chance and cannot be avoided. Random error is due to factors which we do not or cannot control -
Random error causes one measurement to differ slightly from the next. It comes from unpredictable changes during an experiment. The main reason for random error are limitations of instruments, environmental factors and slight variations in procedure. For example :-

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⇒ when weighing yourself on a scale, you position yourself slightly differently each time.

⇒ 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

~~Spectrum~~ - specimen -

⇒ Measuring your height is affected by minor posture changes.

⇒ Random errors in experimental measurements are caused by unknown and unpredictable changes in the experiments.

Because random error always occur and cannot be predicted its important to take multiple data points and average them to get a sense of the amount of variation and estimate the true value -

X ————— X

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Question : 2

B): What are the different reasons due to which gross error occurs in Measurement? Explain Briefly.

Ans: The Gross errors occurs due to/ Because of the human mistakes. For examples Consider the person during/ using the instruments takes the wrong reading or they can record the incorrect data. Such Type of error comes under the gross errors. The gross error can only be avoided by taking the reading carefully.

Example:

The experimenter reads the 31.5°C reading while the actual reading is 21.5°C . This happen because of the oversights. The experimenter takes the wrong reading and

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takes the wrong reading and because of which the error occurs in the measurement.

Such type of error is very common

in the measurement - The complete elimination

of such type of error is not possible.

Some of the gross error easily detected

by the experimenter but some of

them are difficult to find -

⇒ Two methods can remove the gross

errors:

1: The reading should be taken very carefully.

Two or more readings should be taken

of the measurement quantity. The readings

are taken by the different experimenters

and at a different point for removing

the error -

X ————— X

Question No: 3

(a) A Galvanometer is an Instrumental use for detecting and measuring current. Moving coil galvanometer can measure smallest amount of current. It consist of:

- i) permanent horseshoe magnet.
- ii) Iron core.
- iii) pivoted spring.
- iv) Non metallic frame scale and pointer.

The spring play very important role in the function of galvanometer with out spring the following function of Galvanometer may be effected.

- i.) There will be no restoring force to push back the pointer to zero and the deflection measurement is disturbed.

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ii) If the spring is not connected to Galvanometer (Moving coil of Galvanometer) the current cannot be passed to the ammeter.

iii) Without spring we cannot measure the current because it is spring deflection proportional to the force and proportional to the current -

iv) There will be no steady equator deflection with spring because there will be no counter Torque for balancing Magnetic Torque -



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Part B

A student ?

Sol:

Given:

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

Required:

$$R = ?$$

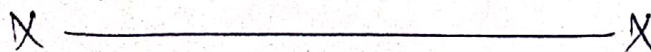
Solution:

$$V = IR$$

$$R = \frac{V}{I} \Rightarrow \frac{20V}{10 \times 10^{-6} A}$$

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

The Resistor is connected in Series
with the Instrument -



2nd Method:

$$V = I_g (G + R)$$

$$\frac{V}{I_g} = G + R$$

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

$$R = \frac{20}{10 \times 10^{-6}} - 0$$

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

The Resistor is connected in series with the instrument -

