Department of Electrical Engineering

Assignment

Date: 20/04/2020

Course Details

Course Title: Instrumentation and Measurement **Module:** 6th (BE)

Instructor: _____ **Total Marks:** 30

Student Details

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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**

Question #01

part(a): A Student mistakenly Connects an ammeter in Series in a Circuit. What will happen? Explain briefly.

Answer:

Ammeters have a low resistance:

An ammeter is designed to be Connected in Series so the Current passes through it. Since you don't want to change the original Circuit, its best if the ammeter has a very low resistance. Adding a very low resistance in Series means the current won't decrease that much and the low resistance takes a Small share of the Voltage.

The problems with Connecting an ammeter in parallel:

If we Connect an ammeter in parallel then there are two problems:

The first is that you haven't put the ammeter in the way of the Current you are toying to measure So you can't be measuring it properly.

The Second is that the Current drawn increases so you're changing the Current you're trying to measure. A low resistance in parallel with a high resistance has an effective resistance of a little less than the low resistance.

This can damage the ammeter because a very big Current flow in it.

Question#02

part(b): A Student mistakenly Connects a Voltmeter in Series in a Circuit. What will happen? Explain Brifly.

Answer:

The Connecting of Voltmeter in Series is equivalent to coanecting a very high resistance in Series with the Circuit. By this only Small insignificant amount of current flow through the Circuit and nearly results in an open Circuit.

Voltmeter have a very high Resistance:

A Combination of a high resistance (like a Voltmeter) Connected in parallel with a Smaller resistance (like a bulb) has an effective resistance of a tiny bit less than the small resistance (bulb). In other words the effect is pretty much the same as just having the bulb alone, which is what we want.

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're not measuring the voltage across a bulb when its lit.

Question # 02

part(a): Random error cannot be easily reduced in measurements. Justify this statement.

Answer:

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.
Random errors cannot be eliminated from an experiment, but most systematic error can be reduced.

Examples of Random Errors:
The main reasons for random error are limitations of instruments, environmental factors, and slight variations in procedure.

→ When taking a volume reading in a flask, you may read the value from a different angle each time.

→ Measuring wind velocity depends on the height and time at which a measurement is taken. Multiple readings must be taken and averaged because gusts and changes in direction affect the value.

→ Measuring your height is affected by minor posture changes.

Question # 02
part(b):

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

Answer:

This Category basically takes into account human oversight and other mistakes while reading, recording and the readings. The most Common of errors, the human error in the measurement Fall under this Category of errors in measurement.

For Example:

The Person taking the reading from the meter of the instrument he may read 23 as 28.

Gross errors can be avoided by using two suitable measures and they are given below:

→ A proper care should be taken in reading, recording the data. Also, calculation of error should be done accurately.

→ By increasing the number of experiments we can reduce the gross errors. If each experimenter takes different reading at different points then by taking average of more readings we can reduce the gross errors.

Types of Gross Error:

1- The thermometer may be misread.

2- Measurement may be made between the wrong pegs.

3. A tape reading of 38.23m may be recorded as 38.32m in the field book.

Question #03

part(a):

What will happen if a Spring in not connected with the Coil of a moving Coil galvanometer? Explain briefly.

Answer:

Moving Coil galvanometer is an electromagnetic device that can measure Small values of Current. It Consists of permanent horseshoe magnets, Coil, Soft iron core, pivoted Spring, non-metallic frame, Scale, and pointer.

Spring in moving Coil galvanometer

The Spring in galvanometer providing the restoring force that pushes the pointer back to zero. It is the hair Springs that make the deflection proportional to the force. And Since the force is proportional to the Current, it permits us to draw

an analogue Scalevunder the pointer and measure the current.

So if the Spring is not connected with the coil the pointer will not pushes back to zero and galvonmeter will show us full scale deflection.

Question# 03
part(b)
A student is performing an experiment in the labortory during which he finds out that the measuring instrument is giving a full scale deflection for a current of 10μA. 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.

Given data:

Current = I_g = $10\mu A$

Voltage = V = 20V

Required:

Value of resistor = R = ?

Formula:

$V = IR$

$V = I_g(G+R)$

Solution:

$V = I_g(G+R)$ ∵ G is neglicted

$\frac{V}{I_g} = 0 + R$

and resistor will be connected in Series.

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

$2 \times 10^6 \Omega = R$

or $R = 2$ MegaΩ or $2 M\Omega$