GOVERNMENT POLYTECHNIC COLLEGE, BHILWARA

CLASS TEST - 2017-18

ELECTRICAL II YEAR

ELECTRICAL MEASUREMENT AND INSTRUMENTATION - EE 204.

Time - 1 Hour Max. Marks-15

NOTE - (i) Answer all questions.
(ii) Marks carried by a question is indicated against it.

Q.1. Define -
(i) Accuracy
(ii) Precision. [2 marks]

Ans. (i) Accuracy - Accuracy is defined as the closeness by which our measured value approaches to the true value. If the difference b/w measured value and true value is small than we can say that our measurement has good accuracy.

eg.- In an experiment we measure value of a resistor using some measurement method. Our measurement give us value 10.1 kΩ and the true value of resistance is 10kΩ then we can say and measurement is quite accurate.

(ii) Precision - Precision refers to the closeness of two or more measurements to each other. It is the ability of an instrument to repeatidly give the same reading for the given parameter and measurement. It shows repeatability of an instrument.

The Precision of an instrument is specified in terms of the num of significant digits.

Q.2. (i) Write about different types of error in measurement.
(ii) Write error function for this equation - $P = VI$ [4 marks] 3+1

Ans. Error is the difference b/w measured value and true value. There are many reasons by which an error can occur in a measurement. we can classify these errors on the basis of their cause of generation. Broadly errors are classified in these 3 groups -

1. Systematic errors
2. Random errors
3. Gross errors.

1. Systematic errors - These occurs due to error in instrument and the measurement system. These errors are cumulative and repetative. This error can be removed by proper calibration of the Instrument. systematic errors can be further classified as -

(i) Instrumental error - It Arises due to Instrument.

(ii) Environmental error - It arises due to atmospheric effects. eg. temp., pressure stray magnetic field. This error can be removed by providing proper magnetic shielding and air conditioning environment.

(iii) Observational error - It arises due to improper use of instrument and taking reading with wrong method. eg. error due to parallex.

2. Random errors - Random errors as it's name signifies arises from some random effects. The net magnitude of random errors is negligible. Because one source of error Compensates for the effect due to other sources of error.

3. Gross Error - These errors arises due to human factors. The main reasons of these errors are carelessness, misuse of the instrument, and inexpoience. These errors are not permanent and not repetative.

Ans. (ii) $P = VI \rightarrow \frac{\delta P}{P} = \frac{\delta V}{V} + \frac{\delta I}{I}$

Q.3. What are absolute Instruments ? Give two examples of them. [2 Marks]

Ans. • Absolute Instruments are those instruments which give o/p in terms of the physical Constants.

• Operational power consumption for these instruments is less compared to secondary instruments, therefore accuracy is high.

• Absolute instruments used as standard instruments in calibrating labs.

eg. - Tangent galvanometer, Raleighs current balance, Absolute Electrometer.

What is the function of controlling torque in a measuring Instrument Write about methods by which it can be generated. [3 marks]

Ans. An indicating instrument require three forces / torque in order to indicate the value of the parameter under measurement.

Controlling torque or the restoring torque has two utilities.

1) It brings the pointer to the steady state position.
2) It brings the pointer to zero position when the parameter under measurement is removed from the terminals of the instrument.

Controlling torque can be produced by a control mechanism and the various control mechanism used in an indicating instrument are -

(i) Gravity control mechanism
(ii) Spring control mechanism

Gravity control mechanism is used where we need to place instrument vertically for continous monitoring. Spring control mechanism is used for laboratory type table top instruments.

Gravity control mechanism is used in instruments which does not have uniform scale. whereas spring control mechanism is employed in instruments which have uniform scale.

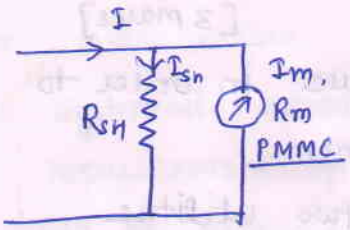
Q. 5. (i) How we can convert one PMMC instrument into an ammeter. Write mathematical expression for parameters.

(ii) A PMMC instrument give full scale deflection for 50 mAmp. It is used as a voltmeter. The value of resistance required so that it can measure 0-10 volts. Resistance of meter is 5000 Ω.
[2+2 = 4 Marks]

Ans. A Basic PMMC instrument can be converted into an ammeter with measuring capability higher than the PMMC current carrying capacity by connecting a low resistance across the PMMC.

This low resistance is known as shunt resistance. Major portion of the current bypasses through it. Thereby protecting the meter

from damage.



In this circuit -

$$I_{SH} R_{SH} = I_m R_m \quad \text{—(1)}$$

$$I = I_m + I_{SH} \quad \text{—(2)}$$

from eqn (1) & (2)

$$\frac{R_m}{R_{SH}} = \frac{I}{I_m} - 1$$

$$m = \frac{I}{I_m} \qquad m = \text{multiplying factor}$$

$$\boxed{R_{SH} = \frac{R_m}{m-1}}$$

Where

R_m = meter resistance

R_{SH} = Shunt resistance

I = max. measuring current of ammeter

I_m = max. current capability of meter

Ans. (ii)

$$m = \frac{V}{v}$$

$$v = I_m R_m = 50 \times 10^{-6} \times 5000$$

$$= 25 \times 10^{-2}$$

$$m = \frac{10}{25 \times 10^{-2}}$$

$$m = 40$$

$$R_S = R_m (m-1)$$

$$= 5000 (39) = 195000 = 195\ k\Omega$$

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