**Subject Name: Electrical & Electronics Instrumentation (EEI)**

**Prepared by : K.SRIDHAR**

**Year and Sem, Department: III-EEE SEM-II**

**Unit – I: Characteristics of Signals and Their Representation**

**Important Points / Definitions:**

* Instrument is a device or mechanism used to determine the present value of the quantity under measurement
* Measurement is the process of determining the amount , degree or capacity by comparison with the accepted standards
* Resolution is the smallest change in a measured variable to which an instrument will respond
* Accuracy is the closeness with which an instrument measurement approaches the true value Of the variable being measured
* Precision is a measure of the consistency of instrument for a given value of input
* Sensitivity is the ratio of change in output of the instrument to a change of input or measured variable
* The static error of a measuring instrument is the numerical difference between the true value of a quantity and its value as obtained by measurement
* Fidelity is the degree to which an instrument indicates the changes in the measured variable without dynamic Error
* Dynamic Error is the difference between the true value of a quantity changing with time and The value indicated by the instrument
* Permanent magnetic moving coil (PMMC) can be used only for DC measurements
* The Torque developed in the PMMC is given by τ=BAIN where B is flux density in air gap, A is Effective coil Area, I is current in the coil, N is number of turns in the coil
* Moving Iron instruments are classified into repulsion and attraction type
* The current Range of the DC Ammeter can be extended by multiple shunts and a range Switch
* A DC voltmeter can be converted into a multi range voltmeter by connecting a number of series Resistors (multipliers) and a range switch
* The true RMS responding voltmeter produces a meter deflection by sensing the heating power of the waveform
* A multimeter also known as a VOM (volt-ohm-milliammeter), is an electronic measuring instrument that measures voltage, current, and resistance

**Questions**

1. Define PMMC and give a classification of Ammeters.

2. Explain the following terms in detail (i) Accuracy (ii) Resolution (iii) Precision

(iv) Expected value

3. Discuss the following characteristics in detail (i) speed of response (ii) Fidelity

(iii) Lag and Dynamic error.

4. List out different AC voltmeters and explain the working of any one voltmeter in detail.

5. Draw the series type Ohmmeter and explain its operation

6. Summarize the features of the Multimeter.

7. Compare various Ohm-Meters.

8. Summarize various Meter protection techniques.

**Fill in the blanks:**

1. A digital voltmeter has a readout range from 0 t0 999 counts the resolution is **1 mv**

2. **Accuracy** refers to the degree of closeness or conformity to the true value of quantity under measurement

3. **Precision** is defined as the ability of the instrument to reproduce a certain set of readings within a given accuracy

4. **Dead zone** is defined as the largest change in input quantity for which there is no output for the instrument

5. **Systematic errors** type of errors are due to shortcomings of the instrument like detective or worn parts

6. **Fidelity** is defined as the degree to which the instrument indicates the change in the measured without dynamic error

7. A set of readings has a wide range and therefore it has **low precision**

8. A. 1mA ammeter has a resistance of 100 O. It is to be converted to 1A Ammeter. The value of shunt resistance is **0.1001 Ω**

9. An 0-10 A ammeter has a guaranteed accuracy of 1 percent of full scale deflection. The limiting error while reading 2.5 A is **9. 4%**

10. In a d’Arsonval galvanometer an iron core is usually used between the permanent magnet pole faces. This is used for **flux density** in the air gap becomes high there by a large deflecting torque is produced.

11. The smallest measurable input change is called **Resolution.**

12. **Systematic** type of errors is due to shortcomings of the instrument like detective or worn Parts.

**Choose the Best:**

1. Which of the following error is caused by poor calibration of the instrument? [ c ]  
a) Random error b) Gross error c) Systematic error d) Precision error

2. Which of the following is not a fundamental quantity? [ d]  
a) Length b) Angle c) Time d) Luminous intensity

3.Which of the following is caused by careless handling? [ b ]  
a) Systematic error b) Gross error  
c) Random error d) None of the mentioned

4. The undesirable characteristics of an measuring system is/are [ D ]

A. Drift B. Dead zone C. Non linearity D. All of these

5.Random errors in a measurement system are due to [ D ]  
  
A. Environmental changes B. Use of uncalibrated instrument  
C. Poor cabling practices D. Unpredictable effects

6.If the bombardment of electrons ceases i.e. when the signal becomes zero then the light emitted by the screen will [ B ]  
  
A. Disappear immediately  
B. Persist for some time then it will disappear  
C. Will not disappear at all  
D. None of these

7.  If the resistance in a circuit is given by 80Ω ± 0.2% and the current flowing

through it is 5A ± 0.1%, then the uncertainty in the power will be [ B ]  
  
A. ± 0.2 % B. ± 0.4 % C. ± 0.6 % D. ± 0.8 %

8.The spring which is used for producing controlling torque in indicating

instruments are made up of materials which is/are  
  
A. Non-magnetic  
B. Not subjected to much fatigue  
C. Low specific resistance and low temperature resistance coefficient  
D. All of these

9. The scale of electrodynamic instrument when it is used as ammeter and when it is used as voltmeter is [ B ]

A. Uniform, uniform  
B. Crowded near zero, crowded near zero  
C. Cramped near zero, cramped in the middle  
D. Uniform, cramped near zero

10. The current sensitive instruments are [ B ]  
  
A. PMMC B. Hot wire instruments  
C. Electrostatic instruments D. Both (a) and (b)

**UNIT-II- Oscilloscope and Digital Voltmeters**

**Important Points / Definitions:**

* The cathode-ray oscilloscope (CRO) is a multipurpose display instrument used for the observation, measurement , and analysis of waveforms
* The electron gun, the deflecting system and the fluorescent screen are the three major components of a general purpose CRT
* The negative voltage at the control grid controls the flow of electrons in the electron beam, and consequently, the brightness of the spot on the CRO screen is controlled.
* The deflecting system in a cathode-ray oscilloscope consists of a pair of horizontal and vertical deflecting plates
* Phosphor is used as screen material on the inner surface of a CRT. The spot of light is produced on the screen where the electron beam hits
* The electron beam striking the screen, release secondary emission electrons. These electrons are collected by an aqueous solution of graphite called Aquadag‖
* Vertical amplifiers determines the sensitivity and bandwidth of an oscilloscope
* The bandwidth of an oscilloscope detects the range of frequencies that can be accurately reproduced on the CRT screen
* The application on sinusoidal waveforms to both deflection plates at the same time produces
* Lissajou’s figures are used in the measurement of frequency and phase of sinusoidal signals
* A storage CRO retains the display up to a substantial amount of time after the first trace has appeared on the screen
* A digital storage oscilloscope (DSO) is an oscilloscope which stores and analyses the signals digitally
* Dual-beam CRO generates two electron beams falling on a single CRT screen to display two waveforms at the same time instant
* The sampling oscilloscope is a special type of oscilloscope used to examine a very fast signals
* CRO probes are classified into active and passive probes

**Questions**

1. Explain the concept of Triggered Sweep CRO along with circuit diagram and derive the deflection sensitivity of a CRT?
2. Explain the Measurement procedure of frequency and phase using Lissajous patterns with one example
3. Discuss the concept of Storage oscilloscope along with circuit diagram
4. Draw the circuit diagram of sampling oscilloscope and explain its operation n detail.
5. Draw the circuit diagram of Dual Trace oscilloscope and explain its operation in detail.
6. Compare various types of probes used for CRO.

**Fill in the blanks:**

1. A vertical amplifier for a CRO can be designed for **Constant** gain band width product.
2. Post acceleration is needed in a CRO if the frequency of the signal is **more than 10**

**MHz .**

1. 3. Verticle deflection plates also called as **Y deflection plates.**
2. Intensity of the beam is varied by **Square wave**.
3. Generally calibrating voltage has a **Triangular wave** in CROS
4. **Frequency** of a signal can be accurately measured by Lissajious pattern
5. **Graticule** is a grid of lines that serves as a scale when making time and amplitudemeasurement
6. The focus adjustment of an oscilloscope varies with **Second anode voltage**
7. Lissajous patrons are used to measure **Frequency and phase.**
8. **Phosphor** material has fluorescence characteristics.

**Choose the Best:**

1. By making use of a CRO \_\_\_\_\_\_\_\_\_ [ A ]  
   a) many characteristics of a signal can be measured  
   b) only a few characteristics of a signal can be measured  
   c) no characteristics of a signal can be measured  
   d) signal can only be displayed
2. How is frequency related to time period? [ C ]  
   a) square proportional b) not related  
   c) directly proportional d) inversely proportional
3. A C.R.O. can be used to measure [ D ]

    A)A.C. voltages only    B)D.C. voltages only

   C)Frequency    D)Any of the above

4. **Principally CRO is a [ B ]**  
 A. Ammeter B. Voltmeter C. Wattmeter D. Watt-hour meter

5. **Which part is called as heart of CRO? [ A ]**  
  
 A. CRT B. Sweep generator C. Trigger circuit D. Amplifier

6. **The Lissajous patterns help in the measurement of [ C ]**  
  
 A. Phase difference between two sine wave  
  
 B. Frequency of one waveform if the frequency of other waveform is known  
  
 C. Both (a) and (b)  
  
 D. None of these

7. In cathode ray oscilloscope, spots are formed on screen having [ C ]

1. Anode B. cathode C. grid D. matrix

8. Output of sweep and time base generator will be [ C ]

1. sinusoidal waveform B)cos waveform
2. saw tooth waveform D )both a and b

9. Electronic device named as cathode ray oscilloscope is known as [ A ]

1. graph plotting device C.plotting device
2. printing device D.both a and b

10.CRO is voltage measuring device. [ True]  
a) True b) False