

## Measurements and Instrumentation

### Two mark Questions & Suggestive Answers

#### UNIT I – INTRODUCTION

**1. What is meant by measurement?**

Measurement means an act or the result of comparison between the quantity and a predefined standard.

**2. Mention the basic requirements of measurement.**

The basic requirements of measurement are

- i. The standard used for comparison purpose must be accurately defined and should be commonly accepted.
- ii. The apparatus used and the method adopted must be provable.

**3. State the two methods for measurement.**

The two methods of measurement are

- i. Direct method
- ii. Indirect method.

**4. State the function of measurement system.**

The measurement system consists of a transducing element which converts the quantity to be measured in an analogous form. The analogous signal is then processed by some intermediate means and is then fed to the end device which presents the results of the measurement.

**5. List the three types of instruments.**

The three types of instruments are:

- i. Mechanical Instruments
- ii. Electrical Instruments and
- iii. Electronic Instruments.

**6. Classify the instrument based on their functions.**

Instruments are classified into three types based on their functions. They are

- i. Indicating instruments
- ii. Integrating instruments
- iii. Recording instruments

**7. Give any three applications of measurement systems.**

The applications of measurement systems are

- i. Monitoring of processes and operations.
- ii. Control of processes and operations.
- iii. Experimental engineering analysis.

**8. Why calibration of instrument is important?**

The calibration of instrument is important since it facilitates to check the instrument against a known standard and subsequently correct its errors to improve accuracy.

**9. List the calibration procedure.**

Calibration procedure involves a comparison of the particular instrument with either a primary standard or a secondary standard with a higher accuracy than the instrument to be calibrated or a instrument of known accuracy.

**10. Define: Calibration**

Calibration is defined as the process by which comparing the instrument with a standard to correct the accuracy.

**11. Mention the functions performed by the measurement system.**

The functions performed by the measurement system are

- i. Indicating function
- ii. Recording function
- iii. Controlling function

**12. List the functional elements of the measurement systems.**

The three main functional elements of the measurement systems are:

- i. Primary sensing element
- ii. Variable conversion element
- iii. Data presentation element

**13. Types of characteristics of the measurement system.**

Characteristics of measurement system is divided into two categories:

- i. Static characteristics
- ii. Dynamic characteristics

**14. Write the main static characteristics?**

The main static characteristics are:

- i. Accuracy
- ii. Sensitivity
- iii. Reproducibility
- iv. Drift
- v. Static error
- vi. Dead zone
- vii. Resolution
- viii. Precision

- ix. Repeatability
- x. Stability

**15. Define static error**

Static error is defined as the difference between the true value and the measured value of the quantity.

$$\text{Static error} = A_t - A_m$$

where  $A_m$  = measured value of quantity

$A_t$  = true value of quantity.

**16. Define resolution**

Resolution is defined as the smallest increment of quantity being measured which can be detected with certainty by an instrument.

**17. Define threshold**

Threshold is defined as the minimum value of the input at which the output starts changing/increasing from zero.

**18. Define linearity**

The linearity is defined as the ability to reproduce the input characteristics symmetrically and linearly.

**19. Define reproducibility**

Reproducibility is defined as the degree of closeness with which a given value may be repeatedly measured. It is specified in terms of scale readings over a given period of time.

**20. Define drift**

Drift is defined as slow variation of reading from a fixed value.

**21. Define speed of response**

Speed of response is defined as the rapidity with which a measurement system responds to changes in measured quantity. It is one of the dynamic characteristics of a measurement system.

**22. Define fidelity**

Fidelity is defined as the degree to which a measurement system indicates changes in the measured quantity without any dynamic error.

**23. Define dynamic error**

Dynamic error is defined as the difference between the true value of the quantity changing with time and the value indicated by the measurement system if no static error is assumed. It is also called measurement error. It is one of the dynamic characteristics.

#### **24. Define retardation delay**

Retardation delay is defined as the retardation delay in the response of a measurement system to changes in the measured quantity.

#### **25. Define time delay**

Time delay is defined as the response of the measurement system begins after a dead zone after the application of the input.

### **UNIT – II - ELECTRICAL AND ELECTRONIC INSTRUMENT**

#### **1. Name the types of instruments used for making voltmeter and ammeter.**

The types of instruments used for making voltmeter and ammeter are

- i. PMMC type
- ii. Moving iron type
- iii. Dynamometer type
- iv. Hot wire type
- v. Electrostatic type
- vi. Induction type.

#### **2. State the advantages of PMMC instruments.**

The advantages of PMMC instruments are:

- i. Uniform scale
- ii. No hysteresis loss
- iii. Very accurate
- iv. High efficiency

#### **3. State the disadvantages of PMMC instruments.**

The disadvantages of PMMC instruments are

- i. Cannot be used for ac measurements
- ii. Some errors are caused by temperature variations

#### **4. State the applications of PMMC instruments.**

The applications of PMMC instruments are

- i. Measurement of D.C voltage and current
- ii. Used in D.C galvanometer.

#### **5. How the range of instrument can be extended in PMMC instruments?**

The range of PMMC instrument can be extended by

- i. connecting a shunt resistor in ammeter type
- ii. connecting a series resistor in voltmeter type.

#### **6. State the advantages of dynamometer type instruments.**

The advantages of dynamometer type instruments are

- i. They can be used for both D.C and A.C measurements
- ii. Free from hysteresis and eddy current errors.

**7. State the advantages of moving iron type instruments.**

The advantages of moving iron type instruments are:

- i. Less expensive
- ii. Can be used for both DC and AC
- iii. Reasonably accurate.

**8. State the advantages of Hot wire type instruments.**

The advantages of Hot wire type instruments are:

- i. They can be used for both dc and ac
- ii. They are unaffected by stray magnetic fields
- iii. Readings are independent of frequency and waveform.
- iv. Gives RMS value directly

**9. What are the constructional parts of dynamometer type wattmeter?**

The constructional parts of dynamometer type wattmeter are:

- i. Fixed coil
- ii. Moving Coil
- iii. Current limiting resistor
- iv. Helical spring
- v. Spindle attached with pointer
- vi. Graduated scale

**10. State the disadvantages of dynamometer type wattmeter.**

The disadvantages of dynamometer type wattmeter are:

- i. Readings may be affected by stray magnetic fields.
- ii. At low power factor it causes error.

**11. Name the errors caused in dynamometer type wattmeter.**

The errors caused in dynamometer type wattmeter are:

- i. Error due to pressure coil inductance
- ii. Error due to pressure coil capacitance
- iii. Error due to methods of connection
- iv. Error due to stray magnetic fields
- v. Error due to eddy current.

**12. Name the methods used for power measurement in three phase circuits.**

The methods used for power measurement in three phase circuits are:

- i. Single wattmeter method
- ii. Two wattmeter method
- iii. Three wattmeter method.

**13. What are the special features to be incorporated for LPF wattmeter?**

The special features to be incorporate for LPF wattmeter are:

- i. Pressure coil circuit
- ii. Compensation for Pressure coil current
- iii. Compensation for Pressure coil inductance.

**14. Name the methods used in wattmeter calibration.**

The methods used in wattmeter calibration are:

- i. Comparing with standard wattmeter.
- ii. Using voltmeter ammeter method.

**15. Name the constructional parts of induction type energy meter.**

The constructional parts of induction type energymeter are:

- i. Current coil with series magnet
- ii. Voltage coil with shunt magnet
- iii. Aluminium disc
- iv. Braking magnet
- v. Registering mechanism.

**16. How voltage coil is connected in induction type energy meter?**

Voltage coil is connected in parallel to supply and load in induction type energy meter.

**17. How current coil is connected in induction type energy meter?**

Current coil is connected in series to the load in induction type energy meter.

**18. Why aluminium disc is used in induction type energy meter?**

Aluminium disc is used in induction type energy meter because it is a nonmagnetic metal.

**19. What is the purpose of registering mechanism?**

The purpose of registering mechanism is to record the energy proportional to the rotations.

**20. Define creeping.**

Creeping is defined as slow but continuous rotation of disc when pressure coil is energized and current coil is not energized.

**21. State the reason why holes are provided in aluminium disc.**

Holes are provided on both sides of aluminium disc to avoid creeping.

**22. Classify the cables according to their sheathing.**

According to their sheathing cables are classified as

- i. Armoured cables
- ii. Unarmoured cables.

**23. State the advantages of price's guard wire method.**

The advantage of price's guard method is leakage current does not flow through the meter and therefore it gives accurate reading.

**24. What are the types of DC potentiometers?**

The types of DC potentiometers are

- i. Crompton's Potentiometer
- ii. Duo-Range Potentiometer
- iii. Vernier Potentiometer
- iv. Brook's Deflectional Potentiometer

### **25. What is a bridge circuit?**

A bridge circuit consists of a network of four impedance arms forming a closed circuit. A source of current is applied to two opposite junctions. The current detector is connected to other two junctions

## **UNIT III - COMPARISON METHODS OF MEASUREMENT**

### **1. What is the basic principle used in potentiometer?**

Basic principle used in potentiometer is that the unknown emf is measured by comparing it with a standard known emf.

### **2. Name the materials used in potentiometer.**

The materials used in potentiometer are

- i. German silver
- ii. Manganin wire

### **3. State the applications of potentiometer.**

The applications of potentiometers are

- i. measurement of unknown emf
- ii. ammeter calibration
- iii. Voltmeter calibration
- iv. wattmeter calibration

### **4. State the advantages of Crompton potentiometer.**

The advantages of Crompton potentiometer are:

- i. More accuracy
- ii. Easy to adjust

### **5. What are the practical difficulties in A.C potentiometers?**

The practical difficulties in A.C potentiometers are:

- i. More complicated
- ii. Accuracy is seriously affected
- iii. Difficulty is experienced in standardization.

### **6. Classify AC potentiometers.**

AC potentiometers are classified as

- i. Polar potentiometer
- ii. Coordinate potentiometer.

**7. How the phase angle is measured in polar type potentiometers?**

The phase angle is measured in polar type potentiometers from the position of phase shifter.

**8. List any two AC potentiometers.**

The two AC potentiometers are

- i. Drysdale Tinsley potentiometer
- ii. Gall Tinsley potentiometer.

**9. State the advantages of AC potentiometers.**

The advantages of ac potentiometers are

- i. They can be used for measurement of both magnitude and phase angle
- ii. They can be used for measurement of inductance of the coil.
- iii. They are used in measurement of errors in current transformers.

**10. State the applications of AC potentiometers.**

The applications of AC potentiometers are

- i. Measurements of self inductance.
- ii. Ammeter calibration
- iii. Voltmeter calibration
- iv. Wattmeter calibration.

**11. State the advantages of instrument transformers.**

The advantages of instrument transformers are

- i. Used for extension of range
- ii. Power loss is minimum
- iii. High voltage and currents can be measured.

**12. State the disadvantage of instrument transformers.**

The disadvantage of instrument transformers is that they cannot be used for DC measurements.

**13. What are the constructional parts of current transformer?**

The constructional parts of current transformer are

- i. Primary winding
- ii. Secondary winding
- iii. Magnetic core.

**14. Name the errors caused in current transformer.**

The errors caused in current transformer are

- i. Ratio error
- ii. Phase angle error

**15. Define ratio error**

Ratio error is defined as the ratio of energy component current and secondary current.

**16. How the phase angle error is created?**

The phase angle is created mainly due to magnetizing component of excitation current.

**17. State the use of potential transformer.**

The use of potential transformer are

- i. They are used for measurement of high voltage
- ii. They are used for energizing relays and protective circuits.

**18. How the current transformer and potential transformer are connected in a circuits?**

In a current transformer is connected in series and potential transformer is connected in parallel

**19. What is the range of medium resistance?**

The range of resistance is about 1 ohm to 100 kilo ohms.

**20. Name the methods used for low resistance measurement.**

The methods used for low resistance measurement are

1. Ammeter – voltmeter method
2. Potentiometer method
3. Kelvin double bridge method
4. Ohm meter method.

**21. What are the types of DC potentiometers?**

The types of DC potentiometers are

- i. Crompton's Potentiometer
- ii. Duo-Range Potentiometer
- iii. Vernier Potentiometer
- iv. Brook's Deflectional Potentiometer

**22. What is a bridge circuit?**

A bridge circuit consists of a network of four impedance arms forming a closed circuit. A source of current is applied to two opposite junctions. The current detector is connected to other two junctions.

**23. What are the types of bridges?**

The types of bridges are:

- i. DC bridge
- ii. AC bridge

**24. What are the types of DC bridges?**

The types of DC bridges are

- i. Wheatstone bridge
- ii. Kelvin Double bridge

**25. What are the types of AC bridges?**

The types of AC bridges are

- i. Capacitance comparison bridge
- ii. Inductance comparison bridge
- iii. Schering bridge
- iv. Maxwell's Inductance and capacitance bridge
- v. Hay's bridge
- vi. Anderson bridge
- vii. Wien bridge

**26. Classify the cables according to their sheathing.**

According to their sheathing cables are classified as

- i. Armoured cables
- ii. Unarmoured cables.

**27. State the advantages of price's guard wire method.**

The advantage of price's guard method is leakage current does not flow through the meter and therefore it gives accurate reading.

**28. How the earth resistance is measured?**

Earth resistance can be measured by using earth megger.

**29. Which type of detector is used in AC bridges?**

The detectors used in AC bridges are

- i. Vibration galvanometers
- ii. Tunable amplifier
- iii. Head phones

**30. Name the sources of errors in AC bridge measurements.**

The sources of errors in AC bridges are

- i. Errors due to stray magnetic fields
- ii. Leakage errors
- iii. Eddy current errors
- iv. Residual errors
- v. Frequency and waveform errors.

**31. State the advantages of Wien bridge.**

The advantage of Wien bridge is the balance equation is independent of frequency and therefore is more accurate.

**32. State the disadvantage of Wien bridge.**

The disadvantage of Wien bridge is a standard variable capacitor. Variable capacitor is more costly.

**33. State the disadvantages of Hay's bridge.**

The disadvantages of Hay's bridge is the balance equation is dependent of frequency and therefore any changes in frequency will affect the measurement.

**34. State the use of Wein bridge.**

Wien bridge is used for the measurement of unknown capacitance and frequency.

**35. Define: Q-factor of the coil**

Q-factor of the coil is defined as the ratio of power stored in the coil to the power dissipated in the coil.

**36. Name the faults that occurs in cables.**

Faults that occur in cables are

- i. Break down of cable insulation
- ii. Short circuit fault
- iii. Open conductor fault.

**37. Name the loop test methods used in location of fault.**

Loop test methods used in location of fault is

- i. Murray loop test
- ii. Varley loop test.

## UNIT-IV

### STORAGE AND DISPLAY DEVICES

**1. List the components of a magnetic tape recorder.**

The components of a magnetic tape recorder are:

- i. Recording head
- ii. Reproducing head
- iii. Tape transport mechanism
- iv. Conditioning devices.

**2. What are the advantages of magnetic tape recorders?**

The advantages of magnetic tape recorders are:

- i. They have a wide frequency range from D.C. to several MHz.
- ii. They have low distortion,
- iii. They have a wide dynamic range which exceeds 50dB. This permits the linear recording from full scale signal level to approximately 0.3% of full scale.
- iv. The magnitude of the electrical input signal is stored in magnetic memory and this signal can be reproduced whenever desired. The reproduced signal can be analyzed by automatic data reduction methods.

### **3. Mention the different methods of magnetic tape recording.**

The different methods of magnetic tape recording are:

- i. Direct recording
- ii. Frequency modulation (FM) recording and
- iii. Pulse duration modulation (PM) recording

### **4. Mention is the purpose of erase head.**

The purpose of erase head is to erase the content of magnetic tape. It consists of a signal of high frequency and level sweeps the magnetic tape thereby completely wiping out the information contained there. This renders the magnetic tape to be used fresh for another signal.

### **5. List the advantages of direct recording.**

The advantages of direct recording are:

- i. This recording process has a wide frequency response ranging from 50 Hz to about 2 MHz for a tape speed of 3.05 m/s. It provides the greatest bandwidth obtainable from a given recorder.
- ii. It requires only simple, moderately priced electronic circuitry
- iii. It can be used for recording voice and in multiplexing a number of channels of information into one channel of tape recording.

### **6. Mention the disadvantages of direct recording.**

The disadvantages of direct recording are:

- i. Direct recording is used only when maximum bandwidth is required and when variations in amplitude are acceptable.
- ii. Direct recording can be used for instrumentation purposes but it is mainly used for recording of speech and music.

### **7. What is drop out ?**

In direct recording, some portions of the tape may not be perfectly recorded owing to dirt or poor manufacture and this is called drop out.

### **8. Mention the two factors in frequency modulation recording.**

The two factors in frequency modulation recording are:

- i. Percentage deviation and
- ii. Deviation ratio.

### **9. Define: percentage deviation**

Percentage deviation is defined as the carrier deviation to centre frequency.

i.e. Percentage deviation or modulation index,  $m = (\Delta f / f_c) \times 100$ ,

where  $\Delta f$  = carrier deviation from centre frequency

$f_c$  = centre or carrier frequency

### **10. Define: Deviation ratio**

Deviation ratio is defined as the ratio of carrier deviation from centre frequency to signal or modulating frequency.

Deviation ratio=  $(\Delta f/f_m)$   
where,  $f_m$  = data signal

### **11. Give few advantages of frequency modulation recording.**

The advantages of frequency modulation recording are:

- i. It is useful when the D.C. component of the input signal is to be preserved or when the amplitude variations of the direct recording process cannot be tolerated.
- ii. This system has wide frequency range, can record from D.C. voltages to several kHz.
- iii. It is free from dropout effect.
- iv. It is independent of amplitude variations and accurately reproduces the waveform of the input signal.
- v. It is used extensively for recording the voltages from the force, pressure and acceleration transducers.
- vi. It is extremely used for multiplexing in instrumentation systems.

### **12. List few disadvantages of frequency modulation recording.**

The disadvantages of frequency modulation recording are :

- i. The circuitry of an FM recording system is more complicated than that of a direct recording system. This complexity of circuitry is an account of separate modulation systems.
- ii. It has a limited high frequency of about 80 kHz.
- iii. It requires a high tape speed.
- iv. It requires a high quality of tape transport and speed control and therefore expensive than the direct recording system.

### **13. Enumerate the merits and demerits of pulse width modulation recording.**

The merits of pulse width modulation recording are:

It has the ability to simultaneously record information from a large number of channels.

It has a high accuracy due to the fact that it can be self-calibrated.

It has a high 3/N ratio.

The demerits of pulse width modulation recording are :

It has the limited frequency response

It has a highly complex electronic circuitry and therefore, the reliability of such systems are low.

It is used only for special applications such as flight recorders, where a large number of slowly changing variables are involved.

### **14. What is the operation of a serial printer ?**

The operating of serial printer is to produces a single character at a time, usually moving from left to right across a page. It prints 200 characters per second.

### **15. Mention the purpose of line printers.**

The line printers are used to print line by line instead of characters. It prints

4000 lines per minute.

**16. Give the operation of page printer.**

Page printer prints a line at a time, but can be stopped and restarted only after printing the full page. The top Speed is 45,000 lines per minute.

**17. List the classification of printer.**

Printers are classified into three broad categories. They are

- i. Impact and non-impact printers.
- ii. Fully formed character and dot matrix character printer
- iii. Character at a time and a line at time.

**19. What is impact and non-impact printers?**

Impact printers form characters on a paper by striking the paper with a print head and squeezing an inked ribbon between the print head and paper.

Non-impact printers form characters on the paper by spraying ink from a jet.

**20. Write short notes on printer character set.**

Mini and micro computers use ASCII codes for the printers. They are specified using the 48 character set, the 64 character set, the 96 character set or the 128 character set. The entire 128 character ASCII set contains 32 characters normally used for communication and control.

**21. What is daisy wheel printer ?**

Daisy wheel printer is a fully formed character printer, designed for computer usage and has characters mounted on the periphery of a spinning print head similar to a daisy wheel. They are capable of bidirectional printing.

**22. Give short notes on dot-matrix printers.**

In dot-matrix printers, the characters are formed by printing a group of dots to form a letter, number or other symbol. It can print any combination of dots with all available print position in the matrix.

**23. List the important features of CRTs.**

The important features of CRTs are:

- i. Size
- ii. Phosphor
- iii. Operating voltages
- iv. Deflection voltages
- v. Viewing screen

**24. What is meant by deflection sensitivity in cathode ray tube ?**

The deflection sensitivity of the cathode ray tube is usually stated as the D.C. voltage required for each cm of deflection of the spot on the screen

**25. List the requirements of a sweep generator.**

The requirements of a sweep generator are:

- i. The sweep must be linear.
- ii. The spot must move in one direction only, i.e. from left to right only, else the signal will be traced backwards during the return sweep. This means that the sweep voltage must drop suddenly after reaching its maximum value. These requirements call for a sweep voltage having a linear sawtooth waveform.

**26. What is meant by recurrent sweep in cathode ray tube ?**

When the sawtooth, being an A.C. voltage alternates rapidly, the display occurs respectively, so that a lasting image is seen by the eye. This repeated operation is known as recurrent sweep.

**27. What is intensity modulation in CRT?**

In some applications, an A.C. signal is applied to the control electrode of the CRT. This causes the intensity of the beam to vary in step with signal alterations. As a result, the trace is brightened during the positive half cycle and diminished or darkened during negative half cycle. This process is called intensity modulation or z-axis modulation. It produces bright segments or dots on the trace in response to positive peak or dim segments or holes in response to negative peaks.

**28. Mention the methods that are used for generating the two electron beams within the CRT.**

The methods that are used for generating the two electron beams within the CRT are the double gun tube and split beam method.

**29. Mention the two storage techniques used in oscilloscope CRTs.**

The two storage techniques used in oscilloscope CRTs are mesh storage and phosphor storage.

**30. CRO has become an universal tool in all kinds of electrical and electronic investigation. Why ?**

CRO has become an universal tool in all kinds of electrical and electronic investigations because in CRO, the vertical input voltage is the voltage under investigation and it moves the luminous spot up and down in accordance with the instantaneous value of the voltage. When the input voltage repeats itself at a fast rate, the trace (display) on the screen, appears stationary on the screen.

**31. Name the components of a CRO.**

The Components of CRO are:

- i. cathode ray tube (CRT) along with electron gun assembly
- ii. deflection plate assembly
- iii. fluorescent screen
- iv. glass envelope and
- v. base.

**32. What is an electron gun ?**

An electron gun is the source of focussed and accelerated electron beam.. The electron gun which emits electrons and forms them into a beam consists of a heater, a cathode, a grid a pre-accelerating anode, a focussing anode and an accelerating anode.

**33. Name the basic circuitry of CRO.**

The basic circuitry of CRO are named as :

- i. Vertical (Y) deflection system
- ii. Horizontal (X) deflection system
- iii. Synchronization
- iv. Blanking circuit
- v. Intensity (z-axis) modulation
- v. Positioning controls
- vi. Focus control
- vii. Intensity control
- viii. Calibration control
- ix. Astigmatism.

**34. Write notes on dual trace cathode ray oscilloscopes.**

In a dual trace CRO, there are two separate vertical input channels A and B and they use separate attenuator and preamplifier stages. Hence the amplitude of each input, as viewed on the oscilloscope, can be individually controlled. After preamplification, the two channels meet at an electronic switch and this has the ability to pass one channel at a time into the vertical amplifier via the delay line.

**35. State the purpose of a Lissajous pattern in CRO.**

The Lissajous pattern is used for determining the frequency and phase angle. The particular pattern results when sine waves are applied simultaneously to both pairs of the deflection plates (X and Y axis).

**36. What is a LED ?**

The LED is basically a semiconductor PN junction diode capable of emitting electromagnetic radiation under forward conduction.

**37. List the different materials used in manufacturing LED's**

The different materials used in manufacturing LEDs are

- i. Gallium Arsenide (GaAs) - red
- ii. Gallium Arsenide Phosphide (GaAsP) - red or yellow
- iii. Gallium Phosphide (GaP) - red or green.

**38. How are LCDs created ?**

LCDs are created by sandwiching a thin (10 to 12um) layer of a liquid-crystal fluid between two glass plates. A transparent, electrically conductive film or backplane is put on the rear glass sheet. Transparent sections of conductive film in the shape of the character are coated on the front glass plate. When a voltage is applied between a segment and the backplane,

an electric field is created in the region under the segment. This electric field change the transmission of light through the region under the segment film and display the segment.

**39. List the characteristics of LCD.**

The characteristics of LCD are:

- i. They are light scattering.
- ii. They can operate in a reflective or transmissive configuration.
- iii. They do not actively generate light and depend on ambient or back light for their operation

**40. Name the two commonly available types of LCDs.**

The two commonly available types of LCDs are:

- i. Dynamic scattering and
- ii. Field effect type

**41.State the purpose of dot matrix displays.**

Excellent alphanumeric characters can be displayed by using dot matrix LEDs with one LED at each dot location

**42. Write the two writing patterns of dot matrix displays.**

The two writing patterns of dot matrix displays are:

- i. Common anode or common cathode connection .
- ii. X-Y array connection (economical and can be extended vertically or horizontally using a minimum number of wires).

**UNIT-V**

**TRANSDUCERS AND DATA ACQUISITION SYSTEMS**

**1. Define: Transducer**

A transducer is defined as a device that converts a physical quantity to be measured into a proportional electrical signal.

**2. Write the parameters of electrical transducer.**

The parameters of electrical transducer are:

- i. Linearity
- ii. Sensitivity
- iii. Dynamic range
- iv. Repeatability
- v. Physical size

**3. List the advantages of electrical transducers.**

The advantages of electrical transducers are:

- i. Electrical amplification and attenuation can be easily done.

- ii. Mass-inertia effects are minimized.
- iii. Effects of friction are minimized.
- iv. Uses very small power level.
- v. Electrical output can be easily transmitted and processed for the purpose of measurement and display
- vi. The output can be indicated and recorded remotely at a distance from the sensing medium.

#### **4. Differentiate sensor and transducer**

A transducer consists of a sensor/detector and transduction element. Sensor converts the physical quantity into a measurable quantity. Transduction element converts this measurable quantity into electrical signal.

#### **5. Give the types of potentiometer.**

The types of potentiometer are:

- i. Translatory
- ii. Rotational
- iii. Helipot

#### **6. Give the limitations of thermistor.**

Limitations of thermistor are:

- i. Non-linearity in resistance Vs temperature characteristics.
- ii. Unsuitable for wide temperature range.
- iii. Very low excitation current to avoid self-heating.
- iv. Need of shielded power lines, filters etc., due to high resistance.

#### **7. In what principles, inductive transducer works?**

- i. Variation of self-inductance.
- ii. Variation of mutual-inductance.

#### **8. Write a short note on LVDT.**

LVDT (Linear Variable Differential Transformer) converts the mechanical energy into differential electrical energy. It has single primary winding, and two secondary windings wound on a hollow cylindrical former. A movable soft iron core slides within the hollow former and therefore affects the magnetic coupling between the primary and the two secondaries.

#### **9. List the advantages of LVDT.**

The advantages of LVDT are:

- i. High range of displacement measurement.
- ii. Friction and electrical isolation.
- iii. Immunity from external effects.
- iv. High input and high sensitivity.
- v. Ruggedness
- vi. Low hysteresis and low power consumption.

#### **10. List the limitations of LVDT.**

The limitations of LVDT are:

- i. Large displacements are required for appreciable differential output.
- ii. They are sensitive to stray magnetic fields.
- iii. Dynamic response is limited.
- iv. Temperature also affects the transducer.

**11. List the two physical parameters in strain gauge.**

The two physical parameters in strain gauge are:

- i. The change in gauge resistivity.
- ii. The change is length, wire diameter

**12. List out the features of piezo-electric accelerometer.**

The features of piezo-electric accelerometer are:

- i. Instrument is quite small in size and has a low weight.
- ii. The natural frequency is very high.
- iii. Useful for high input frequencies and the response is poor at low frequencies.
- iv. The crystal is a source with a high output impedance and in order to avoid loading effect, a voltage monitoring source of a high input impedance should be used.

**13. Define: Inductive Transducer**

Inductive transducer is defined as a device that converts physical motion into a change in inductance. It may be either of active or passive type.

**14. Give the principle of capacitive transducers.**

Capacitive transducer principle is a linear change in capacitance with change in the physical position of the moving element, which may be used to provide an electrical indication of the elements position.

$$C=KA/d$$

Where K= dielectric constant

A= total area of capacitor surfaces.

d = distance between two capacitive surfaces.

**15. What is meant by digital transducers?**

Digital transducers convert physical quantity into direct digital signal like pulses. They are also called encoders. They are normally in the form of linear or rotary displacement transducers. They do not require analog to digital converter to realize the digital data.

**16. Classify digital transducers.**

Digital transducers are classified into,

- i. Tachometer transducers
- ii. Incremental transducers
- iii. Absolute transducers

**17. What is data acquisition system?**

The system used for data processing, data conversion, data transmission, data storage is called data acquisition system.

**18. Briefly specify the analog data acquisition system elements.**

A typical analog data acquisition system consists following elements.

i) Transducers, ii) Signal conditioner, iii) Multiplexers, iv) Calibrating equipment, v) Integrating equipment, vi) Visual display devices, vii) Analog recorders, viii) Analog computers.

**19. What is data logger?**

A data logger is nothing but an application of a DAS which measures and records data from various instruments located at different parts very quickly and accurately without much efforts.

**20. What are the advantages of data logger? (or) What are functions of data logger?**

The main advantage of the data logger is that it can measure the output from almost all type of transducer and can log the value automatically. It can detect the outputs going beyond the limits specified. It takes the corrective action. To record all or selected readings on variety of output devices, data loggers are used. It can also pass the data to a computer for further processing.

**21. What is multiplexing?**

Basically multiplexing means combining different signals. In data processing and handling it is the frequently required to combine number of analog signals in to a single digital channel. Similarly to this it is also required to combine a digital channel into number of analog channels.

**22. What is the purpose of Multiplexing?**

In data processing and handling it is oftenly needed to combine number of analog signals into a single digital channel or number of digital signals into a single analog channel – to achieve this multiplexing of signals is applied.

**23. What are the essential functional operations of a digital data acquisition system?**

The essential functional operations of a digital data acquisition system are as follows

- i) It measures and records the signal obtained from sensors.
- ii) It processes a data involving simple comparison operation to complicated arithmetic manipulations.
- iii) It collects data rapidly using shift registers and other high resolution devices.
- iv) It converts analog data into digital signal using ADC.

**24. Name the various analog to digital conversion techniques.**

1. Single ramp or single slope. 2. Dual Slope 3. Successive approximation 4. Flash 5. Delta Modulation 6. Adaptive delta modulation.

**25. What is the need of sample and hold circuit in A/D converter?**

Over the period of conversion of signal, if the rate of change of input is high, then the level of the signal changes during conversion. To avoid this, sample and hold circuit is connected before converter to hold the input to converter throughout the period of conversion.

**26. What is quantization error?**

The quantization error is the unavoidable uncertainty about the exact value of the input voltage. It is dependent on number of bits. For increasing number of bits, resolution is very fine and thus quantization error is less.

**27. What is the need of ADC and DAC in digital data acquisition system?**

The digital data acquisition system consists ADC. The output of majority sensors is analog type in nature. In digital DAS and other microprocessor based systems, for measurement, control, process and display, it is necessary to convert analog signal into digital signal. For this purpose ADC is used.

**28. What is the function of signal conditioner?**

The function of signal conditioner are

1) Amplification 2) Modification or modulation 3) Impedance matching 4) Data Processing 5) Data Transmission.

**29. When do you call an instrument to be intelligent?**

An instrument is called to be intelligent when its circuitry consists smart sensors.

**30. What are the functions of data logger?**

It automatically records the readings of various instruments located at different parts of the plant. It can measure the output from almost all the types of transducers and logs the value automatically. It records the data quickly, accurately and effortlessly.

**31. Draw the block diagram for 4-bit analog to digital converter.**