

SYLLABUS**EE6404 MEASUREMENTS AND INSTRUMENTATION 3 0 0 3****1. INTRODUCTION 9**

Functional elements of an instrument – Static and dynamic characteristics – Errors in measurement – Statistical evaluation of measurement data – Standards and calibration.

2. ELECTRICAL AND ELECTRONICS INSTRUMENTS 9

Principle and types of analog and digital voltmeters, ammeters, multimeters – Single and three phase wattmeters and energy meters – Magnetic measurements – Determination of B-H curve and measurements of iron loss – Instrument transformers – Instruments for measurement of frequency and phase.

3. COMPARISON METHODS OF MEASUREMENTS 9

D.C & A.C potentiometers, D.C & A.C bridges, transformer ratio bridges, self-balancing bridges. Interference & screening – Multiple earth and earth loops – Electrostatic and electromagnetic interference – Grounding techniques.

4.STORAGE AND DISPLAY DEVICES 9

Magnetic disk and tape – Recorders, digital plotters and printers, CRT display, digital CRO, LED, LCD & dot matrix display – Data Loggers

5. TRANSDUCERS AND DATA ACQUISITION SYSTEMS 9

Classification of transducers – Selection of transducers – Resistive, capacitive & inductive transducers – Piezoelectric, optical and digital transducers – Elements of data acquisition system – A/D, D/A converters – Smart sensors.

L = 45**TEXT BOOKS**

1. E.O. Doebelin, 'Measurement Systems – Application and Design', Tata McGrHill publishing company, 2003.
2. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2004.

REFERENCE BOOKS

1. A.J. Bouwens, 'Digital Instrumentation', Tata McGraw Hill, 1997.
2. D.V.S. Moorthy, 'Transducers and Instrumentation', Prentice Hall of India Pvt Ltd, 2007.
3. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw Hill, II Edition 2004.
4. J. B. Gupta, 'A Course in Electronic and Electrical Measurements', S. K. Kataria & Sons Delhi 2003.,

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EE6404- MEASUREMENTS AND INSTRUMENTATION (R2013)
2MARK QUESTIONS AND ANSWERS

UNIT –I - INTRODUCTION

1. What is an error?

The algebraic difference b/w the indicated value and the true value of the quantity to be measured is called an error.

2. What is calibration?

It is the process of making an adjustment or marking a scale so that the readings of an instrument agree with the accepted value and the certified standard.

3. When static characteristic are important?

The instruments measure the quantity which do not vary with time, the static characteristic of an instruments play an important role.

4. What is measurand?

The physical, chemical, electrical quantity, Property, process, variables or a condition to be measured is referred as measurand.

5. When dynamic characteristic of an instrument are important?

The instruments are subjected to rapidly varying inputs then it is necessary to study the dynamic relations b/w input & output.

6. What is an accuracy?

It is the degree of closeness with which the instruments reading approaches the true value of the quantity to be measure.

7. What is precision?

It is the measure of consistency or measurements. it denotes the amount by which the individual readings are departed about the average value of readings.

8. What is sensitivity?

It denotes the smallest change in the measured variable to which the instruments to be responds. The units of sensitivity are in mm/unit quantity to be measure.

9. What is Threshold?

If the i/p quantity is slowly varied from zero onwards, the o/p does not vary until some min value of the i/p is reached.

10. What is resolution?

It is the smallest increment of quantity being measured which can be certainly detected by an instrument.

11. What is linearity?

It is the ability of an instrument to reproduce the input characteristic symmetrically & linearly.

12. What is the stability?

The ability of instruments to retain its performances through its specified operating life & the storage life is called stability.

13. What is tolerance?

The max allowable error in the measurement is specified in terms of a value is called tolerance.

14. What is a true value?

The actual value of a variable to be measurand is called true value. This is practically impossible hence it is not possible to determine.

15. Which are standard i/p used to obtain dynamic behavior of an instruments?

The step, ramp, parabolic & sinusoidal i/p are used in practice to obtain the dynamic behavior of an instruments

16. What is fidelity?

It indicates how much faithfully the system reproduces the changes in the input. it is the ability of n instruments to produce a wave shape identical to the wave shape of an input with respect to time.

17. What is setting time of instruments?

Before indicating the final reading the pointer of the instruments takes finite time, during which it oscillates or moves slowly to its final value.

18. What is Secondary instrument?

The instrument in which the reading shown by the instruments gives directly the measurements of the quantity to be measure is called secondary instruments.

19. What is an absolute instrument?

The instrument which gives the magnitude of the quantity to be measure in terms of the physical constant of the instruments is called absolute instruments.

20. How are the errors classified?

Gross errors also called personal errors, Random errors due to unknown reasons.

21. What is meant by measurement?

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

22. Mention the basic requirements of measurement.

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

23. What are the 2 methods for measurement?

Direct method and indirect method.

24. Explain 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.

25. Define Instrument.

Instrument is defined as device for determining the value or magnitude of a quantity or variable.

26. List the types of instruments.

- The 3 types of instruments are ·
 1. Mechanical Instruments
 2. Electrical Instruments and
 3. Electronic Instruments.

27. Give the applications of measurement systems.

- The instruments and measurement systems are used for
- Monitoring of processes and operations.
- Control of processes and operations.
- Experimental engineering analysis.

28. Why calibration of instrument is important?

The calibration of all instruments is important since it affords the opportunity to check the instrument against a known standard and subsequently to errors in accuracy.

29. Explain 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 an instrument of known accuracy.

30. Define Calibration.

It is the process by which comparing the instrument with a standard to correct the accuracy.

16 mark questions

1. Give the methods of using any three standard input used for analyzing the dynamic response of a system with neat sketch.
2. Write briefly on instrument standards and its types with examples.
3. Why is feedback necessary in instrumentation system.
4. Explain briefly about the various types of errors.
5. Define and explain the arithmetic mean, average deviation, standard deviation.

UNIT –II - ELECTRICAL AND ELECTRONICS INSTRUMENTS**1. State the classification of measuring instruments?**

Indicating instruments, recording instruments, integrating instruments.

2. State the essentials torque required for successful operation of instruments?

- a) Deflecting torque
- b) Controlling torque
- c) Damping torque.

3. What are the various ways by which deflecting torque is produced?

- a) Magnetic effect
- b) Thermal effect
- c) Electrostatic effect
- d) induction & hall effect.

4. How controlling torque is produced?

Using springs, & using control weight the controlling torque is produced.

5. Why scale of gravity is non-uniform?

The quantity to be measured is proportional to $\sin \theta$ rather than in gravity control which is not a uniform. Hence scale calibrated is not in uniform.

6. What are the different ways of producing damping torque in instruments?

- a) Air friction damping,
- b) Fluid friction damping,
- c) Eddy current damping.

7. What is the basic principle of PMMC instruments?

A current carrying coil placed in the permanent magnet field experiences a force, proportional to the current it carries.

8. For which type of measurements PMMC devices are suitable?

It is suitable for d.c. only as in a.c. the torque produced on coil is reversing which cannot give accurate readings.

9. State the principle of moving iron instruments?

A soft iron piece is brought near the magnet gets attracted by the magnet is the principle of moving iron attraction type instruments. When like polarities of magnet face each other they experience a force of repulsion.

10. List the possible cause of errors in moving iron instruments?

- a) hysteresis errors,
- b) Temperature errors,
- c) Stray magnetic field errors
- d) Frequency & eddy current errors.

11. State the precautions to be taken while using D.C ammeters?

Never to be connected across the source of emf or load.

Must always be in series.

Must connect in proper polarities.

12. What are the requirements of a shunt?

The temperature coefficient of shunt and the meter should be low & should be as equal as possible. The shunt resistances should be stable and constant with time.

13. What is sensitivity of volt meter?

$S = 1/\text{full scale deflection current}$. Its unit is ohm/volt.

14. What is loading effect?

The low sensitive instruments is used in high resistances circuit then its gives a lower reading than the true reading.

15. State the precautions to be taken while using d.c.voltmeter?

The voltmeter resistances are very high & it should always be connected across the circuit or component whose voltage is to be measure.

16. What are the requirements of a multiplier? a)

Their resistances should not change with time.

b) They should not non-inductively wound for a.c.meters.

17. Which torque is absence in energy meter?

The controlling torque is absence in energy metering energy meter continues rotation of disc is required & it is not necessary to reset it to zero every time & hence controlling torque is absence.

18. Which adjustment is required in energmeter?

Main speed adjustment possible by braking magnet & power factor adjustment possible by the shading ring.

19. What is an electronic voltmeter?

The voltmeter which uses rectifiers' diodes and other support ting electronic circuits to produce current proportional to the quantity to be measured is called electronic voltmeter.

20. State the advantage of an electronic

voltmeter? a) Low level signal detection

b) Low power consumption

c) Less loading effect

d) High sensitivity.

21. What are the constructional parts of dynamometer type wattmeter?

Fixed coil
Moving Coil
Current limiting resistor
Helical spring
Spindle attached with pointer
Graduated scale

22. Write down the deflecting torque equation in dynamometer type wattmeter.

$T_d = VI \cos \phi$

23. State the disadvantages of Dynamometer type wattmeter.

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

24. Name the errors caused in Dynamometer type wattmeter.

Error due to pressure coil inductance
Error due to pressure coil capacitance
Error due to methods of connection
Error due to stray magnetic fields
Error due to eddy current.

25. How the errors caused by pc inductance is compensated.

By connecting capacitor in parallel to the resistor.

26. How the errors caused by methods of connection is compensated

By using compensating coil.

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

(i) Single wattmeter method
(ii) Two wattmeter method
(iii) Three wattmeter method.

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

Pressure coil circuit
Compensation for Pressure coil current
Compensation for Pressure coil inductance.

29. Define Phantom loading.

Method by which energizing the pressure coil circuit and current coil circuits

Separately is called phantom loading.

30. State the use of phantom loading.

Power loss is minimized.

31. Name the methods used in Wattmeter

By comparing with standard wattmeter.
By using voltmeter ammeter method.
By using Potentiometer.

32. What are the types of energy meters?

Electrolytic meters , Motor Meters , Clock Meters

**Electro
lytic
meters**

33. Name the constructional parts of induction type energy meter.

Current coil with series magnet,
Voltage coil with shunt magnet,
Al disc
Braking magnet Registering mechanism.

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

It is connected in parallel to supply and load.

35. How current coil is connected in induction type energy meter.

It is connected in series to the load.

36. Why Al disc is used in induction type energy meter.

Aluminum is nonmagnetic metal.

37. What is the purpose of registering mechanism?

It gives valuable number proportional to the rotations.

38. What is the purpose of braking mechanism?

It provides necessary braking torque.

39. Define creeping.

Slow but continuous rotation of disc when pc is energized and cc is not energized.

40. State the reason why holes are provided in AI disc.

To avoid creeping holes are provided on both sides of AI disc.

41. Name the types of instruments used for making voltmeter and ammeter. PMMC type

Moving iron type

Dynamometer type

Hot wire type

Electrostatic type Induction type.

42. State the advantages of PMMC instruments

Uniform scale.

No hysteresis loss

Very accurate

High efficiency.

43. State the disadvantages of PMMC instruments

cannot be used for ac m/s

Some errors are cause by temperature variations.

44. State the applications of PMMC

instruments? m/s of dc voltage and current

Used in dc galvanometer.

45. How the range of instrument can be extended in PMMC instruments.

In ammeter by connecting shunt resistor In

voltmeter by connecting a series resistor.

46. State the advantages of Dynamometer type instruments

Can be used for both dc and ac m/s.

Free from hysteresis and eddy current errors.

47. State the advantages of Moving iron type instruments

- Less expensive
- Can be used for both dc and ac
- Reasonably accurate.

48. State the advantages of Hot wire type instruments

- Can be used for both dc and ac
- Unaffected by stray magnetic fields
- Readings are independent of frequency and waveform.

49. State the advantages of instrument transformers.

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

50. State the disadvantage of instrument transformers.

- Cannot be used for dc measurements.

51. What are the constructional parts current transformer?

- Primary winding
- Secondary winding,
- Magnetic core.

52. Name the errors caused in current transformer.

- Ratio error
- Phase angle error

53. Define ratio error.

The ratio of energy component current and secondary current is known as the ratio error.

54. How the phase angle error is created.

It is mainly due to magnetizing component of excitation current.

55. State the use of potential transformer.

- Used for m/s of high voltage
- Used for energizing relays and protective circuits.

56. Name the errors caused in potential transformer.

- Ratio error, Phase angle error

57. How the CT and PT are connected in the circuits.

CT is connected in series and PT is connected in parallel.

16 mark questions

1. With the neat diagram explain the construction , working principle of three phase wattmeter
2. Write short notes on working of a single phase energy meter and current transformer.
3. How the digital voltmeters are classified and explain with example.
4. Explain the phase meter principle employed in measuring equipments.
5. Explain the principle auto ranging and automatic polarity indication used in digital voltmeters.

UNIT-III - COMPARISON METHODS OF MEASUREMENTS**1. What is the basic principle used in potentiometer.**

In potentiometer the unknown emf is measured by comparing it with a std known emf.

2. Name the potentiometer material used.

German silver
Manganatic wire

3. Define standardization.

It is the process by which adjusting the current flows through the potentiometer coil to make the voltage across the standard cell is equal.

4. State the applications of potentiometer.

Used for m/s of unknown emf
Used for ammeter calibration
Used for Voltmeter calibration
Used for wattmeter calibration

5. State the advantages of crompton potentiometer.

More accurate
Easy to adjust

6. What are the practical difficulties in ac potentiometers?

More complicated
Accuracy is seriously affected
Difficulty is experienced in standardization.

7. Classify ac potentiometers.

Polar potentiometer
Coordinate potentiometer.

8. How the phase angle is measured in polar type potentiometers.

It is measured from the position of phase shifter.

9. Name some ac potentiometers.

Drysdale Tinsley potentiometer
Gall Tinsley potentiometer

10. State the advantages of ac potentiometers.

Can be used for m/s of both magnitude and phase angle
Can be used for m/s of inductance of the coil.
It is used in m/s of errors in CTS

11. State the applications of ac potentiometers.

M/s of self inductance.
Ammeter calibration
Voltmeter calibration
Wattmeter calibration.

12. State the use of a.c bridges.

AC bridges are used for the m/s of self and mutual inductance and capacitance.

13. State the balance equation used in ac bridges.

The product of opposite branch impedances is equal.

14. Name the bridge circuits used for the m/s of self inductance.

Maxwell's bridge
Maxwell-Wein Bridge
Anderson bridge
Hay's bridge.

15. Name the bridge circuits used for the m/s of capacitance.

De Sauty's bridge, Schering Bridge, Wein bridge.

16. Name the bridge circuits used for the m/s of mutual inductance.

The Heaviside Campbell Bridge
The Campbell Bridge.

17. Which type of detector is used in ac bridges?

Vibration galvanometers are used.

18. Name the ac sources used in ac bridges.

AC supply with step-down transformer
Motor driven alternator
Audio frequency and radio frequency oscillator.

19. In which cases audio frequency oscillators are used as ac source.

For high frequency ac requirement audio frequency oscillators are used.

20. Name the sources of errors in ac bridge m/s.

Errors due to stray magnetic fields
Leakage errors
Eddy current errors
Residual errors
Frequency and wave form errors.

21. State the advantages of Maxwell-wein Bridge.

The balance equation is independent of frequency and therefore more accurate.

22. State the disadvantage of Maxwell-wein Bridge.

This method needs standard variable capacitor. Variable Capacitor is costliest.

23. State the disadvantages of Hay's bridge.

The balance equation is dependent of frequency and therefore any changes in Frequency will affect the m/s.

24. State the use of Wein Bridge.

It is used for the m/s of unknown capacitance and frequency.

25. What is the use of Campbell Bridge?

This is used for the m/s of mutual inductance.

26. What is meant by inductometer?

The std variable mutual inductance meter is called as inductometer.

27. Define Q-factor of the coil.

It is the ratio between power stored in the coil to the power dissipated in the coil.

28. Name the components of iron loss.

Eddy current loss
Hysteresis loss.

29. Name the faults that occur in cables.

Break down of cable insulation
Short circuit fault
Open conductor fault.

30. Name the loop test methods used in location of fault.

Murray loop test
Varley loop test.

31. How leakage errors are minimized in ac bridge circuits.

By using high grade insulation.

32. Classify resistance.

Low resistance
Medium resistance
High resistance

33. What is the range of medium resistance?

Resistances of about 1 ohm to 100 kilo ohms are called medium resistance.

34. Name the methods used for low resistance measurement.

Ammeter – voltmeter method
Potentiometer method
Kelvin double bridge method
Ohm meter method.

35. Name the methods used for medium resistance measurement

Ammeter – voltmeter method
Substitution method
Wheatstone bridge method

Carey fosters bridge method.

36. Where high resistance m/s is required?

Insulation resistance of cables
High resistance circuit elements
Volume resistivity of a material
Surface resistivity.

37. State the advantages of Wheatstone bridge method.

Free from errors
The balance is quite independent of source emf

38. State the advantages of Kelvin double bridge method.

Errors owing to contact resistance, resistance of leads can be eliminated by using This Kelvin double bridge.

39. How resistance is measured in loss of charge method.

In this method a capacitor is charged and discharge d for specific time period and from this resistance is measured.

40. State the balance equation used in bridge method

The products of opposite branch resistances are equal.

41. How the earth resistance is measured.

By using earth megger the value of surface earth resistance can be measured.

16 mark questions

1. What is hay's bridge and derive the balanced equation.
2. What is common mode voltage and how it is effective to generate series mode voltage which causes serious errors.
3. Explain the concept of ground loop and ground loop interference.
4. Derive the bridge balance equation for basic ac bridges.
5. Explain briefly about the dc potentiometers with types.

UNIT –IV - STORAGE AND DISPLAY DEVICES**1. What are X-Y recorders?**

It is used to record one variable varying with other variable. It consists two separate self balancing potentiometers and the resulting motion of the pen gives a plot on a graph for variation of one variable with other.

2. What are digital display devices?

The devices which provides a visual display of numbers , letters ,symbols w.r.t an electrical input are called digital display devices.

3. In what respect LCD display are advantages over LED displays?

The LCD displays are advantages than LED display when the power requirement is to be kept very low and the character height is to be increased.

4. What is LED?

It is semiconducting p-n junction diode capable of emitting electromagnetic radiation when it is in forward bias. The emission depends on semiconducting materials.

5. What is power requirements LCD?

The power requirements LCD to scatter or absorb light is of the order of few micro watt/cm. it operates at low voltages of the order of 1 to 5 volt.

6. What are the different materials used in

LED? a) Gallium – Arsenide-Phosphide

b) Gallium- Phosphide

c) Gallium – Arsenides

7. Mention different types of display devices?

- a) LED
- b) LCD
- c) dot matrix display.

8. What is the principle of operation of LCD?

LCDs do not emit or generate light but alter externally illumination & when electrical signal is applied modulated light.

9. State true or false CRO can regarded as fast as X-Y plotter ?

True- In CRO an electron emission beam can be deflected in two direction X & Y .it is possible to produce spot to produce two dimensional display.

10. define photo-voltaic?

It is based on the photo-voltaic effect. when an open circuit p-n junction is illuminated , large number of electron hole pair are generated in the region near the junction.

11. Define photo-conductive cells?

It is based on photo-conductive effect. when light falls on the material through glass window, the covalent bond ionize due to energy in the radiation.

12. Mention the use of photo-voltaic

It is used widely in the application in satellite & solar heaters. Also used in infrared detectors& sensing lights.

13. What are the advantages of digital X-Y recorder?

1. Simultaneous storage of number of input signals is possible
2. The data can be plotted using multi-pen plotting system.
3. The recorder can record or draw
4. The hardware and software interface provides better ca

14. What are the components of magnetic tape

1. Recording head
2. Magnetic Tape
3. Reproducing Head
4. Tape Transport Mechanism
5. Conditioninf Devices

15. What are the method s used for magnetic tape recording ?

1. Direct recording
2. Frequency modulation recording
3. Pulse duration modulation recording

16. What are the types of digital data

- i).incremental digital recorders
- ii).synchronous

17. What are the main parts of CRT?

- i).electron gun
- ii).deflection system

- iii).fluorescent screen
- iv).glass tube or envelope
- v).base

18. What are the types of storage techniques used in CRT?

- i).mesh storage
- ii).phosphor storage

19. What are the advantages of digital storage oscilloscope?

1. It is easier to operate and has more capability.
2. The storage time is infinite.
3. The cursor measurement is possible.
4. The characters can be displayed on screen along with the waveform which can indicate waveform information such as minimum, maximum, frequency, amplitude Etc
5. The X-Y plots, B-H curve can be displayed.

20. What are applications of LED?

1. Seven segment display
2. Alpha numeric display

21. What are the advantages of using LEDs?

1. LEDs are small in size, and hence can be regarded as point source of light.
2. The brightness of light emitted by LED depends on the current flowing through LED. Hence the brightness of light can be smoothly controlled by varying the Current.
3. LEDs are fast operating devices.

22. What are the types of LCD according to the operation?

1. Dynamic scattering
2. Field effect

23. What are advantages of LCD?

1. Less power consumption
2. Low cost
3. Uniform brightness with good contrast
4. Low operating voltage and current

24. What are disadvantages of LCD?

1. Poor reliability
2. Limited temperature range
3. Poor visibility in low ambient temperature
4. Slow speed
5. Requires an ac drive

25. State the limitations of analog storage oscilloscope ?

1. The waveform can be preserved for finite amount of time only
2. As long as image is required to be stored, the power must be supplied to the tube.
3. The storage cathod ray tube requires additional power supplies
4. The stored wav form cannot be reproduced on the external device like computer
5. The storage cathode ray tube is very much expensive.

26. Classify different recorders used in instrumentation.

1. Electronic recorders
2. Analog recorders
3. Digital recorders

27. Give the classification of printers?

1. Impact printers - line printer and dot matrix printer
2. Non-impact printers-laser printer and ink-jet printer

28. List the applications of X-Yrecorder?

1. speed-torque characteristics of motors.
2. Regulating curves of power supply
3. Plotting strain-stress characteristics, hysteresis curves,etc
4. Lift drag wind tunnel test.
5. Plotting electrical characteristics of various materials such as resistance versus Temperature.

29. What is the principle of dot matrix display?

The operation of this display is based on the principle that under breakdown Condition, a gas near cold cathode gas filled tube emits light the cold cathode Indicators are called nixie tubes. These are based on the principle of glow Discharge in a cold cathode gas filled tubes.

30. What are the types of X-Y recorder?

1. Analog X-Y recorders
2. Digital X-Y recorders

16 mark questions

1. Explain briefly about the different recorders used in instruments.
2. Draw and explain the structure and main components of conventional cathode ray tubes
3. Write the short notes on dot matrix display and bar graph display
4. Explain the modes of operation of digital storage oscilloscope
5. Write short notes on RZ and NRZ technique used in digital data Recording.

UNIT –V - TRANSDUCERS AND DATA ACQUISITION SYSTEMS

1. What is an active transducer?

An element which produces electrical signal in the form of voltage or current d.c. or a.c. without using external power, when stimulated by any form of physical quantity is called an active transducer.

2. What is an passive transducer?

A transducer producing variation in the electrical parameters when stimulated in any form of physical quantity, requires an external excitation to, generate any electrical signal is called passive transducer.

3. What is the function of transducers?

It is a devices which converts one form of energy into some other form. It is the main components in an instruments system.

4. Define transducer?

A transducer is a devices which converts one form of physical quantity into some another form of energy such as electrical, hydraulic pneumatic useful for Measurement Technique.

5. what is digital transducer?

It is devices which produce an electrical output in form of pulse which forms an unique code generated for each discrete value sensed.

6. What do you mean by sensor & transducer?

It is define as devices which produce a measurable response to change a physical quantity. The transducer is devices which transform the output of sensor to an Electrical output.

7. What do you mean by analog transducer?

It converts the i/p quantity into an analog o/p which is a continuous function of time.

8. What is a thermocouple ?

It is temperature transducer. It is based on the principle that when heat is applied to the hot junction, temperature difference exists b/w two junctions.

9. What is the application of thermistor?

The sensitivity of thermistor is large High sensitivity & high relativity

Use for thermal conduction measurements.

10. What are thermistor?

Thermistor is a contraction of thermal- resistor. It is a semiconducting devices which behaves as a thermal resistor having negative temp coefficient.

11. Which elements used in resistances thermometer?

Platinum,

copper,

nickel, &
tungsten.\

12. What are the limitation of the thermistor?

- a) Non-linear resistances vs. temperature characteristic
- b) not suitable over wide temperature.

13. Write the principle of operation of thermoelectric transducer?

It is based on the principle that the resistances of the material changes with change in temperature, generating thermal emf.

14. Mention any two salient features of RTD?

- a) High accuracy
- b) wide temperature range.

15. State seeback effect?

When heat is applied to hot junction, a temperature difference exists b/w the two junctions, causing generation emf. The generated emf is proportional to the difference in the temperature.

16. What is POT?

It is potentiometric resistive transducer consisting a wire wound resistive component along with sliding contact called wiper

17. Mention the use of capacitive transducer?

It is used for the measurements of pressure, level, and displacement. It can also measure for linear & angular displacement.

18. Why are the capacitive transducer most useful for small system?

The force requirements of capacitive transducer are very small. Hence the power required to operate them is also very small.

19. What are the uses of LVDT?

- a) Its displacement ranging from few mm to cm is to be measure
- b) use to measure force, weight, pressure.

20. What is normal linear range of LVDT?

LVDT are available with range as low as ± 0.05 inch to as high as ± 25 inch.

21. Which materials are used in piezoelectric transducer?

The material used in this is quartz, Rochelle & tourmaline

22. Name the transducer used for sensing acceleration?

- a) Potentiometric accelerometer,
- b) LVDT accelerometer,
- c) piezo-electric accelerometer,
- d) strain gauge accelerometer,

23. What is shaft encoder?

It's a rotational displacement transducer which is used to measure the angular motion of a body about axis of rotation. It works on the principle whose displacement is to measure when rotates.

24. What is the advantage of digital shaft encoder?

- a) It has only one disk
- b) It rotate with body whose displacement is to be measure.

25. What is optical encoder?

It is displacement transducer consisting of sector with pattern of alternator or randomly placed opaque & transparent areas.

26. What is D/A conversion?

A digital to analog conversion accepts n bit input word in binary and produce an analog signal proportional to it.

27. What are the performance parameters of DAC?

1. Resolution
2. monotonicity
3. conversion time
4. settling time
5. stability
6. accuracy

28. What is R-R ladder?

For D/A conversion the shunt resistors are used to generate n binary weighted currents. These resistors look like a ladder hence called R-R ladder.

29. What are various errors in DAC?

1. Linearity error
2. Offset error
3. Gain error

30. What is A/D conversion?

The quantizing process where an analog signal is converted into an equivalent binary word.

31. State the performance parameters of ADC?

1. Resolution
2. Quantization error
3. Conversion time

32. Which are the techniques used for A/D conversion?

1. Single slope
2. Dual slope
3. Successive approximation
4. Flash
5. Delta modulation

16 mark questions

1. Explain different strain gauges with a principle of operation.
2. Explain pressure capacitive transducer with neat diagram.
3. Explain the working principle of displacement transducers.
4. With neat diagram explain the potentiometer resistive transducers.
5. Explain the working principle of LVDT with neat sketch.