EE8403-MEASUREMENT & INSTRUMENTATION
2MARK: UNIT-1

1. Define instrument.

An instrument is a device for determining the value or magnitude of a quantity.

2. What are the types of instruments?

a. Mechanical instrument
b. Electrical instrument
c. Electronic instrument

3. Write the dynamic characteristics of any measurement system.

a. Step change
b. Linear change
c. Sinusoidal change
d. Lag
e. Fidelity
f. Dynamic error

4. What is standard? What are the different types of standards?

A standard is a physical representation of a unit of measurement. A known accurate Measure of physical quantity is termed as standard.
Types:
a. Primary standard
b. Secondary standard
c. International standard
d. Working standard.

5. What is calibration?

Calibration is the process of checking the accuracy of instrument by comparing the instrument reading with a standard meter of known accuracy.

6. Define arithmetic mean.

Arithmetic mean is calculated by taking the sum of all readings divided by the number of readings.

7. Define the terms precision and sensitivity.

Precision: It is a measure of the repeatability of a series of measurements.

Sensitivity: It is the measure of change in reading of an instrument for a given change in the Measured quantity.

8. Define static error.

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.

9. Define accuracy.

The degree of closeness of a measurement comparedto the true value.

10.Write the static characteristics of measuring instruments.

a. Accuracy
b. Precision
c. Sensitivity
d. Resolution
e. Error

11.What are the different calibration methodologies?

(i)Direct calibration

a. Meter calibration
b. Generator calibration c.
Transducer calibration

(ii)Indirect calibration

a. Meter calibration
b. Generator calibration
c. Transducer calibration

12.Define instrumental errors.

These errors arise due to inherent short coming in the instrument, misuse of the instruments and loading effects.

13.List the different types of possible errors in measurements.

a. Gross error
b. Systematic error
c. Environmental error
d. Observational error
e. Random error

14.What is the need for measurement?

The need for the measurement is to know about the unknown magnitude.

15.Write the need for calibration.

The need for calibration means is to check the accuracy and reliability.

16.What are the basic elements of a measurement system?

a. Primary sensing element.
b. Variable conversion element.
c. Variable manipulation element.
d. Data transmission element.
e. Data presentation element.

17.What is meant by measurement?

The process of determining the present value is called as measurement.

18.What are the methods of measurements?

a. Direct method.
b. Indirect method.

19.Define environmental error.

This error occurs due to external conditions to the measuring device, including conditions in the area surrounding the instrument, such as the effects of change in temperature, humidity, magnetic or electrostatic fields.

20.Define sensitivity

The ratio of the change in output of the instrument to a change of input or measured value is called sensitivity.

UNIT –I
16 MARK

1. Describe the functional elements of an instrument with its block diagram. (MAY 05, 07, 09, 10 DEC 07,09,10) (16)
2. What are the three categories of systematic errors in the instrument and explain in detail. (MAY 06, 07, DEC 05, 06, 07,09,11)
3. Explain in detail calibration technique and draw the calibration curve in general. (MAY 04, 11, DEC 06, 07)
4. Discuss in detail various types of errors associated in measurement and how these errors can be minimized? (MAY 06,07, DEC 05, 06, 07, 09, 11)
5. Define the following terms in the context of normal frequency distribution of data a)Mean value, b) Deviation, c) Average deviation, d) Variance e)Standard deviation. (MAY 05 ,08, 10, 11 DEC 07, 08,)
6. Define and explain the static characteristics of an instrument. (MAY 06, 11 DEC 04, 08, 09,
7. Define and explain the types of static errors possible in an instrument. (MAY 05,06,07,11, DEC 04,05, 06, 07,08, 09, 11)
8. Discuss in detail the various static and dynamic characteristics of a measuring system. (MAY 06, 11 DEC 04, 08, 09, 11)
9. For the given data, calculate a) Arithmetic mean, b) Deviation of each value,c) Algebraic sum of the deviationsX1 = 49.7, X2 = 50.1, X3 = 50.2, X4 = 49.6, X5 = 49.7(MAY 05 ,08, 10, 11 DEC 07, 08,)
10. Explain in detail the types of static error. (MAY06, 07, DEC 05, 06, 07,09,11)
11. What is standard? Explain the different types of standards? (MAY 05, 08, DEC 11)

UNIT-II

2-MARKS

1. Write the classification of measuring instruments.

Electrical instruments are mainly classified as
a. Indicating instruments
b. Recording instruments
c. Integrating instruments

2.Define indicating instruments.

Indicating instruments are used to indicating the magnitude of unknown quantity. The examples are ammeters, voltmeters etc.

3. Define recording instruments.

These instruments give a continuous record of the given input quantity. The examples are various types of recorders.

4. Define integrating instruments.

These instruments measure the total quantity of electricity delivered over period of time. Example: energy meter.

5. What are the requirements of an instrument?

The following systems must be present in an instrument
a. Deflecting system producing deflecting torque.
b. Controlling system producing controlling torque.
c. Damping system producing damping torque.

6. What are the types of instruments?

It consist of two types

Permanent magnet moving coil instrument.
Moving iron instruments

- ➢ Moving iron attraction type.
- ➢ Moving iron repulsion type.

7. What are the advantages of digital instruments over analog instruments?

a. High accuracy.
b. High input impedance.
c. Reading speed is very high.
d. Digital output can be directly recorded.

8.State the essential torques required for successful operation of an instruments.

- •Deflecting torque
- •Controlling torque
- •Damping torque.

9.Which torque is absent in energy meter? Why?

The controlling torque is not present in energy meter. As the disc of energy meter has to rotor continuously and there is no need to reset its position any time, the controlling torque is not required.

10. Give the importance of iron loss measurement.

Many apparatus like transformer, generator, and motor etc. use magnetic materials for their construction. The design of transform core, armature for motor and generator is very important. To have high Efficiency, the losses must be as minimum as possible. Hence from ideal designing point of view, the iron loss measurement is important.

11.Name the methods used in wattmeter calibration.

The methods used in wattmeter calibration are:
•Comparing with standard wattmeter.
•Using voltmeter ammeter method.
•Using Potentiometer.

12.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.

13. State the disadvantages of Dynamometer type wattmeter.
•Readings may be affected by stray magnetic fields.
•At low power factor it causes error.

14. State the advantages of Moving iron type instruments

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

15. State the advantages of instrument transformers.

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

16. State the disadvantages of PMMC instruments

•Cannot be used for ac m/s
•Some errors are caused by temperature variations.

17. What are the different methods of measurement of frequency in the power frequency range?

a. Mechanical resonance type or vibrating reed type frequency meter.
b. Electrical resonance type frequency meter.
c. Weston frequency meter.

18. How are the analog instruments classified on the basis of method used for comparing the unknown quantity?

a. Electrostatic type instruments.
b. Electromagnetic type instruments.
c. Instruments using magnetic effect.
d. Instruments using heating effect.
e. Instruments using hall effect.

19. Give the advantage of moving iron meters?

a. The same instrument can be used for both A.C and D.C measurement.
b. Torque /weight ratio is very high henceerrors due to friction is very high.
c. These instruments are highly accurate.
d. These instruments are simple in construction.

20. What is creeping in energy meters?

A slow but continuous rotation of energy meter disc even when there is no current flowing through the current coil but only the pressure coil is energised, is called creeping. Some other factors that cause creeping are excessive voltage across the pressure coil, vibrations and external magnetic fields.

UNIT –II
16 MARKS

1. Describe the construction and working of a permanent magnetic moving coil instruments. (DEC 04, 06 MAY 05, 07)

2. Explain the design of three phase wattmeter and give the reactive power measurement in 3Φcircuits. (MAY 08)

3. How B-H curve is determined for a ring specimen. (DEC 08, 11, 10, MAY 04,06, 07, 11)
4.Explain the function of three phase wattmeter and energy meter. (MAY 08)

5.Discuss in detail the working of the successive approximation DVM.(DEC 05)

6. Explain with a neat sketch the construction and working principle of 1Φ induction type energy meter.(DEC 03, 06, 09, MAY 05, 08, 09, 11)

7. With a neat diagram explain the construction and working of electrodynamometer type instruments. Also derive its torque equation. (MAY 06)

8. Explain with neat diagram the working of linear ramp type DVM. (MAY 04, 06)

9. With block diagram explain the working principle of digital frequency meter.(DEC 11, MAY 04, 09, 10)

10.Give detailed notes on Instrument transformers. (DEC 05, 09, MAY 11)

UNIT-III
2MARKS

1.What is potentiometer?

A potentiometer is an instrument designed to measure an unknown voltage by comparing it with a known voltage.

2.Mention the applications of potentiometers.

a. Measurement of small emfs (up to 2V).
b. Comparison of emf of two cells.
c. Measurement of high emfs (up to 250V).
d. Measurement of resistance.
e. Measurement of current.

3.What are the types of potentiometer?

a.D.C potentiometer
b.A.C potentiometer.

4.What are the types of DC potentiometer?

a. Simple potentiometer.
b. Direct reading potentiometer.
c. Crompton potentiometer.
d. Modern form of slide wire potentiometer
.

5.What is the main difference between in operation between DC potentiometer and AC potentiometer?

In the DC potentiometer only the magnitude of the unknown emf and slide wire voltage drop must be made equal to obtain balance, where as in the AC potentiometer the phases of the two voltages, as well as their magnitudes, must be equal for balance to be obtained.

6.What are the types of AC potentiometers?

a. Polar potentiometer.
b. Co ordinate potentiometer

7.Mention some applications of AC potentiometers.

a. Measurement of self inductance
b .Calibration of ammeter
c. Calibration of voltmeter
d. Calibration of wattmeter

8.What are the uses of bridge circuits?

The bridge circuits are mainly used for measuring unknown quantities such as resistance, inductance and capacitance.

9.What are the two main types of bridges?

a.DC bridges
b.AC bridges

10.What are the types of DC bridges?

a. Wheatstone bridge
b .Kelvin's bridge
c. Kelvin's double bridge.

11.What is a Wheatstone bridge?

Wheatstone bridge is used for measurement of medium resistances in the range of 1 Ω to 100 kΩ

.

12.What is Kelvin's bridge?

Wheatstone bridge is not suitable for measurement of very low resistance .Kelvin's bridge is a modification of Wheatstone bridge and is used to measure values of resistance below 1Ω.

13.What is Kelvin's double bridge?

This circuit consists of double bridge. This circuit is mainly used for measuring very low resistances from 0.00001Ω to 1Ω.

14.What is Schering bridge?

The Schering bridge, one of the most important AC bridges, is used for measurement of capacitors, it is also measures the insulating properties of the electrical cables and equipments.

15.What is Maxwell's bridge?

The Maxwell bridge is used to measure both a given inductance and its series resistance by comparison to a standard capacitance.

16.What is Anderson bridge?

It is a modified version of the Maxwell's inductance capacitance bridge. In this method the self inductance is measured in terms of a standard capacitor.

17.What is earth loop?

Earth loops form a distinct part of the guarding system of electrical equipments.

18. State the use of potential transformer.

Used for m/s of high voltage

Used for energizing relays and protective circuits.

19. Name the errors caused in potential transformer.

Ratio error

Phase angle error.

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

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

UNIT – III

16 MARK

1. Explain in detail about the laboratory type DC potentiometer.(MAY 07 DEC 10

2. Give the applications of AC potentiometers. (DEC 07)

3. Describe about the multiple earth and earth loops. (DEC 09, 11, MAY 10)

4. Explain the different techniques of grounding. (DEC 09, 11, MAY 10)

5. With fundamentals distinguish between DC and AC potentiometers, and give any twospecific applications for each. (MAY 09, DEC 11)

6. Discuss the advantages and limitations of electromagnetic interference in measurements. (MAY 10,DEC 07,08,11)

7. Explain Kelvin's double bridge method for the measurement of low resistance. (MAY 10 DEC 10)

8. Explain how inductance in measured by using Maxwell's bridge. (MAY 09, DEC 08)

9. Explain the working principle of Anderson's bridge and also derive its balance equations. (MAY 08,DEC 04)

10. Explain the working principle of Schering Bridge and also derive its balance equations.(MAY 05, 11,DEC 08)

11. Explain the frequency measurement in Wien's bridge (DEC 08)

UNIT IV

2MARKS

1. List the components of a magnetic tape recorder.

The components of a magnetic tape recorder are :

1. Recording head
2. Magnetic head
3. Reproducing head
4. Tape transport mechanism
5. 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. Directrecording

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 tae. 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:

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 bahdwidtn obtainable from a given recorder.

It requires only simple, modulately priced electronic circuitry.

It is used to record signals where information is contained in the relation between frequencyand amplitude, such as spectrum analysis of noise.

5.Mention the disadvantages of direct recording.

The disadvantages of direct recording are:

Direct recording is used only when maximum bandwidth is required and when variations in amplitude are acceptable.

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

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 =(∆f/fc) x 100,where ∆f = carrier deviation from centre frequency fc = 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, ♪ = (∆f/fm)
Where, fm = data signal

11. List few disadvantages of frequency modulation recording.

The disadvantages of frequency modulation recording are :

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.

It has a limited high frequency of about 80 kHz.

It requires a high tape speed.

It requires a high quality of tape transport and speed control and therefore expensive than the direct recording system.

12. Give few advantages of frequency modulation recording.

The advantages of frequency modulation recording are:

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.

This system has wide frequency range can record from D.C. voltages to several kHz.

It is free from dropout effect.

It is independent of amplitude variations and accurately reproduces the waveform of the input signal.

It is used extensively for recording the voltages from the force, pressure and acceleration transducers.

13. List the classification of printer.

Printers are classified into three brad categories. They are

Impact and non-impact printers.

Fully formed character and dot matrix character printer

Character at a time and a line at time.

14. 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 availble print position in the matrix.

15. 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:

16. List the requirements of a sweep generator.

The requirements of a sweep generator are:

The sweep must be linear.

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.

17. 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

18. 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.

19. 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 for their operation on ambient or back lighting

20. State the advantages of price's guard wire method.

In this method leakage current does not flows through the meter and therefore it gives accurate reading.

UNIT – IV
16 MARK

1. Describe the construction and working of LCDs, mention the difference between light scattering and field effect types of LCDs, and also explain the advantages of LCDs (DEC 05 , 07, 08, MAY 06, 07)
2. Give the basic block diagram of a digital data recording system. (DEC 09)
3. Explain with a neat sketch
a) dot matrix displays b) Bar graph displays (MAY 04, 06, 11, DEC 06, 10)
4. Explain the basic elements of a magnetic tape recorder. (MAY 04, 05, 08, 09, 10, 11 DEC\ 03, 05, 06,07, 11)
5. Explain the block diagram of oscilloscope with a neat sketch (MAY 07, 11, DEC 05)
6. Describe the basic components of a CRT. (MAY 04, 06, 09, DEC 10, 11)
7. Write short notes on liquid crystal displays. (DEC 05, 07, 08, MAY 06, 07)
8. With a neat block diagram, explain the working of digital storage oscilloscope. (MAY 07 , 11, DEC 05)
9. Discuss briefly about the applications of LED. (MAY 04, 09, DEC 09)
10. Discuss in detail the construction of a storage type oscilloscope. What are the accessories for a CRO? (MAY 07,DEC 05)
11. Describe the performance of digital plotter. (MAY 07, DEC 10)
12. Write short notes on Printers. (MAY 04, 06, 11, DEC 06, 10)

UNIT V

2MARKS

1. Mention 2 disadvantages of capacitive transducer?

   Output impedance of capacitive transducer is very high. So its measuring circuit becomesvery complicated.

   The capacitance of capacitive transducer change with change in temperature or account ofpresence of small external matter.

   Example: dust particles, moisture.

2. Give the 2 types of principles for the operation of optical transducers

   INTRINSIC SENSOR: In this the fiber optic cables itself is the sensor.

   EXTRINSIC SENSOR: In this fiber optic cable is only used to guide light to or from aconventional sensor.

3. Write the function of transducer?

   It converts one type of energy into another.

4. Give any 2 applications of smart sensors.

   - Self calibration.
   - Computation.
   - Communication.
   - Multisensing.

5. Define inverse transducer with example.

   An inverse transducer is defined as device which converts an electrical quantity into a nonelectrical quantity.

   It is a precision actuator which has an electrical input and a low power non electrical output.

6. Mention any 4 types of analog to digital convertor?

   Flash type of convertor

   Staircase convertor

   Tracking convertor

   Successive approximation type

7. What are the classifications of encoder?

   Tachometer transducers,
   Incremented transducers,
   Absolute transducers.

8. What is the need of sample and hold circuit in A/D convertor?

   Sample and hold circuits are the devices that store analog information and reduce the caperture time of an A/D convertor. A sample hold is a simply a voltage memory device in which an input voltage is acquired and then stored on a high quality capacitor.

9. Define the primary and secondary transducers?

   Primary Transducer:

   When the input signal is directly sensed by the transducer and physical phenomenon isconverted into electrical form directly then such a transducer is called the primary transducer.

Secondary Transducer:

When the input signal is sensed first by some detector or sensor and then its output being of some from other than input signals is given as input to a transducer for conversion into electrical form, then such a transducer falls in the category of secondary transducers.

10. State the performance parameters of ADC

Resolution.
Quantization error.
Conversion time.

11. How do you classify transducers?

On the basis of transduction form used.
As primary and secondary transducers.
As active and passive transducers.
As analog and digital transducers.
As transducers and inverse transducers.

12. What is telemetry?

Telemetry is a highly automated communications technique with the help of which measurements and data collection are done at remote.

13. What is piezo-electric effect?

A piezoelectric material is one in which an electric potential appears across certain surfaces of the crystal if the dimensions of the crystals are changed by the application of a mechanical force this potential is produced by the displacement of charges .

This effect is reversible. This phenomenon is known as piezoelectric effect.

14. Explain the working principle of capacitive transducers?

The principle of capacitive transducer is based on the familiar equation of capacitance of parallel plate capacitor.$C= \varepsilon A /d$

15. What are the selection criteria for the transducer?

Operating range.
Sensitivity.
Environmental conditions
Errors.
Accuracy.

16. What is meant by strain gauge? What for it is used?

It is an example of a passive transducer that uses the variation in electrical resistance in wires to sense the strain produced by a force on the wires.

17. What is POT? It is active or passive transducer?

POT is a resistive potentiometer used for the purpose of voltage division.
It consists for a resistive element provided with a sliding contact called as wiper.
The POT is a passive transducer since it requires an external power source for its operation.

18. Which are the materials used in piezo-electric transducer? (Jun 2006)

Rochelle salt.
Ammonium dihydrogen phosphate (ADP).
Quartz.
Ceramic made with barium titanate, dipottasium tartrate, potassium dihydrogen phosphate and lithium sulphate.

19. Name the transducer that uses sensing acceleration?

Piezo-electric transducer.

20. Mention the use of capacitive transducer?

Capacitive transducers can be used for measurement of both linear and angular displacements.
It can be used for measurement of force and pressure.
Can be used for measuring humidity.
It is used in conjunction with mechanical modifiers for measurement of volume, density etc.

21. Write any four basic requirements of transducer?

RUGGEDNESS: It should be capable for withstanding overload.
LINEARITY: The input-output characteristics should be linear.
NO HYSTERISIS: It should not give any hysteresis during measurement while input signal is varied from low to high value and vice versa.
RESIDUAL DEFORMATION: There should be no deformations on removal of load after long period of time

UNIT – V
16 MARK

1. Explain the principle of inductive and capacitive transducer. (MAY 05, 07, 09, DEC 05,
2. Explain the construction and working of LVDT with a neat sketch (DEC 03, 06, 08, 09, MAY 05)
3. Discuss in detail about resistive transducers. (DEC 11)
4. Explain the various types of temperature transducers. (DEC 04, 05, 08)
5. Explain the function of piezoelectric transducer. (DEC 04, 11, MAY 04, 09, 10, 11)
6. Explain the binary weighted resistor technique of D/A conversion. (MAY 04, 06, 07)
7. Describe the piezoelectric transducer and give the formula for coupling coefficient. (DEC 04, 11, MAY 04,09, 10, 11)
8. Discuss R-2R ladder type D/A converter. (DEC 05)
9. Explain the various types of ADC with suitable sketches. (DEC 09)
10. Explain the working principle of various types of DAC with neat sketches. (MAY 04, 06,
11. Explain the successive approximation type ADC. (DEC 06, 07, 08, 10, MAY 05)