DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Question Bank

UNIT 1

Sub. Code: 18ECO133T   Year/ Sem: III / VI

Sub. Name: SENSORS AND TRANSDUCERS   Regulation: 2018

1.Which of the following is an example for electrical quantity

- a. Humidity
- b. light flow
- c. displacement
- **d. change in capacitance**

2.Which of the following criteria is not true about sensor classification?

- a. Transduction principles using physical or chemical effects
- b. Primary input quantity, that is, the measurand
- c. Property
- **d. sensitivity**

3. -----------------------is 'a device that transfers power from one system to another in the same or in the different form.

- a. Sensor
- **b. Transducer**
- c. Signal conditioning circuit
- d. Input signal

4.Which of the following is not an example for non-industrial sensors

- a. Automobiles
- b. Medical products
- c. Aircrafts
- **d. CMOS image sensors**

5. Which of the following property is not used in sensor classification

- a. Temperature
- b. Pressure
- c. Proximity and displacement
- **d. Error rate**

6._____parameters on which sensor classified?

a. Material and technology

b. Application

c. Property and input quantity

d. All the above

7. **The most common techniques for noise reduction are differential signal transmission and passive low pass _____**

a. Filtration

b. Amplifier

c. Relay

d.All the above

8.**Which of the following error is caused by poor calibration of the instrument?**

a.Random error

b.Grosserror

c.Systematic error

d.Precisionerror

9.The sensors are classified on the basis of
       A. Functions
       B. Performance
       C. Output
       D. All of the above

10.It is the ability of the sensor to indicate the same output over a period of time for a constant input.
       A. Stability
       B. Resolution
       C. Error
       D. Impedance

11.**Sensor and signal conditioning jointly referred as _____ ___**

a.Transducer

b.Actuator

c.Relay

d.All the above

12._____is the difference in the output of the sensor for a given input x when x reaches the value in upscale and downscale directions

a.Hysteresis

b.Resolution

c.threshold

d.selectivity

13. The transducer used in weighing machine is

    a. LVDT
    b. Loadcell
    c. Piezoelectric transducer
    d. Capacitive transducer

14. Potentiometer transducers are used for the measurement of

    a. Pressure
    b. Displacement
    c. Humidity
    d. Both a & b

15._____ **describes the performance of the sensor, which does not vary with time.**

a. Static characteristics

b. Dynamic characteristics

c. Environmental characteristics

d. Reliability Characteristics

16. **The _____characteristics of a transducer refer to the performance of the transducer when it is subjected to time varying signal.**

a. Static

b. Dynamic

c. Transient

d. Both a. and b.

17._____is defined as the smallest incremental change in the input that would produce a detectable change in the output.

a.sensitivity

b.Resolution

c.Selectivity

d.Isolation

18._____is the ratio of the incremental output to incremental input

a.Sensitivity

b.Selectivity

c.Resolution

d.Threshold

19._____is the closeness to truevalue
a.Zero stability

b.Accuracy

c.Sensitivity

d.Linearity

20. **_____,** relating the sensor performance after or during exposure to specified external conditions (e.g. pressure, temperature, vibration and radiation).

a. Static characteristics

b. Dynamic characteristics

c. Environmental characteristics

d. Reliability Characteristics

21.The following is not a static performance parameter to be looked into before selecting a parameter.

        A. Range
        B. Deflection
        C. Stability
        D. Error

22**.**The following main dynamic characteristic(s) is usually considered in Mechatronics application of sensors.
        A. Response time

        B. Rise time

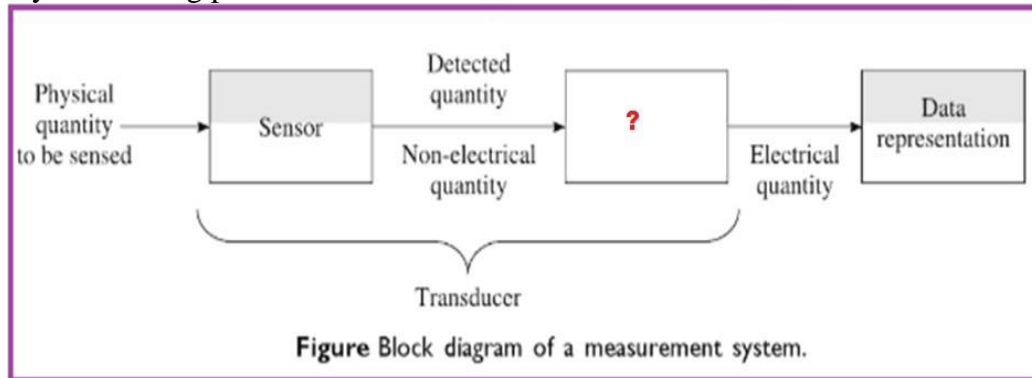   C. Time constant

        D. All of the above

23.It is the time required to come to an output value within the specified error level.
- A. Response time
- B. Rise time
- **C. Settling time**
- D. None of the above

24.Identify the missing parameters

Physical quantity to be sensed → Sensor → Detected quantity / Non-electrical quantity → ? → Electrical quantity → Data representation

Transducer

Figure Block diagram of a measurement system.

    a.dataset
    b.Signal conditioning unit
    c. Measurement
    d.digital system

25.It can be defined as the variation in the constant of proportionality between the input physical quantity and the output electrical signal

a.Resolution

b.Accuracy

c.Precision

d.Linearity

26.Change in output of sensor with change in input is

a.Threshold

b.Slewrate

c.Sensitivity

d.None

27. Smallest change which a sensor can detect is

a.Resolution

b.Accuracy

c.Precision

28. The study of relationship between the input and output, then the input is invariant with respect to time is called as,

a. Static Characteristic of an instrument

b. Dynamic Characteristic of an Instrument

c. Variable Characteristics of an Instrument

d. None of the above

29. Closeness of measured value to true value is _____

a. Accuracy

b. Correction

c. Precision

 d. Uncertainty

30.The desirable Static characteristic of a measuring system are :

a. Accuracy & Reproducibility

b. **Accuracy , Sensitivity & Reproducibility**

c. Drift & Dead zone

d. Static Error

31. _____ can be defined as the tolerance within which a measurement canbe
     Repeated

a.Resolution
b. Accuracy
c. Precision
d. Scale

32. In a measuring system what is the term used to specify a difference between higher and lower calibration values?

a. Range

b. Span

c.Drift

d.Threshold

33. The term_____ is close to precision which is the difference in output y at a given value of the input x when obtained in two consecutive measurements**.**

a.repeatability

b.amplification

c.resolution

d.sensitivity

34. Smallest change in which a sensor can detect,

a. Resolution

 b. Precision

c. Accuracy

d. Scale

35. Which among the following is not a dynamic characteristic?
a. Precession
b.Measuring lag
c. Dynamic error
d. Fidelity

36. Which among the following is not a dynamic characteristic?
a. Response speed
b. Accuracy
c. Retardation type measuring lag
d. Time delay lag

37._____describe the sensors life expectancy

a.Static characteristics

b.Dynamic characteristics

c.Environmental characteristics

d.Reliability Characteristics

38.The ratio of the input impedance of the measuring equipment to the output impedance of the sensor/transducer should be very high in _____sensitive sensor.
   a. Impedence
   b. Current
   c. Voltage
   d. Resistance

39.Sudden or avalanche change in the voltage or current is called _____

a. Dielectric
b. Breakdown
c. Wear out
d. None of the above

40. Which of the following is not a mechanical Energy?

a.Current

b.Pressure

c.Torque

d.Force

41. Which of the following is not belongs to environmental parameter which affects the performance of transducer?

 a. Current

b. Pressure

c. Temperature

d. humidity

42. "There occurs a high local field in the material which may be defect-induced" which then is called

    a. Extrinsic breakdown mechanism
    b. Intrinsic breakdown mechanism
    c. Exponential breakdown mechanism
    d. Log breakdown mechanism

43._____ of the sensors is the complete failure in the normal operation

    a. Catastrophic failure
    b. Short term drifts
    c. Long term drifts and failures
    d. Accelerated ageing test

44. Overlapping of signals between the two adjacent transducer element is called

    a. Noise
    b. Cross talk
    c. Leakage
    d. Breakdown

45. 'Larger voltages upto 50% in excess are applied over different intervals of time' is called

    a. Thermal shock test

b. **Electrical overstress test**
c. Mechanical shock test
d. High temperature burn in\
   Ans: b

46. Mechanical and Thermal characterization involves the mechanical and thermal properties related to the overall -------------

   a. **Reliability**
   b. Flexibility
   c. Strain
   d. Stress

47. Important aspect of Characterization --------------

   a. Flexibility
   b. Strain
   c. Stress
   d. **Reliability**

48. The functional and reliable portion of a batch of sensors or transducers is identified by ------

   a. Data sheets
   b. **Frequent interval of testing**
   c. Previous set of readings
   d. Identical type of sensor

49. Reliability function is given by -------------

   a. $R(x) = 1 + F(x)$
   b. **$R(x) = 1 - F(x)$**
   c. $R(x) = 1 * F(x)$
   d. $R(x) = 1 / F(x)$

50. Identification of failure sensor nodes in High temperature burn in test is done by ---------

   a. **Sensors are subjected to high temperature of about 125°C for 48 hours**
   b. Sensors are baked at high temperature of 250 °C for several hours
   c. Progressively larger voltages up to 50% in excess are applied over different intervals of time
   d. sensors are subjected to -65 °C and 125 °C for about 10 sec for every temperature

51. Identification of failure sensor nodes in High temperature storage bake test is done by --------

   a. Sensors are subjected to high temperature of about 125°C for 48 hours
   b. **Sensors are baked at high temperature of 250 °C for several hours**
   c. Progressively larger voltages up to 50% in excess are applied over different intervals of time

d. sensors are subjected to -65 ˚C and 125 ˚C for about 10 sec for every temperature

52. Identification of failure sensor nodes in Electrical overstress test is done by --------

   a. Sensors are subjected to high temperature of about 125˚C for 48 hours
   b. Sensors are baked at high   temperature of 250 ˚C for several hours
   c. Progressively larger voltages up to 50% in excess are applied over different intervals of time
   d. sensors are subjected to -65 ˚C and 125 ˚C for about 10 sec for every temperature

53. Identification of failure sensor nodes in Thermal shock test is done by --------

   a. Sensors are subjected to high temperature of about 125˚C for 48 hours
   b. Sensors are baked at high   temperature of 250 ˚C for several hours
   c. Progressively larger voltages up to 50% in excess are applied over different intervals of time
   d. sensors are subjected to -65 ˚C and 125 ˚C for about 10 sec for every temperature

      74. Optical Characterization is done by _____
   a. ascertaining absorption coefficient

54. Accelerated ageing test is done instead of Real time operational test for reliability because ------

   a. Difficult to analyze
   b. Difficult to perform
   c. Take more time
   d. Not convenient

55. Accelerated ageing test is done by ------------------

   a. sensors are subjected to -65 ˚C and 125 ˚C for about 10 sec for every temperature
   b. High stress is imposed on sensor – results are used to predict the performance in normal stressed condition
   c. Progressively larger voltages up to 50% in excess are applied over different intervals of time
   d. sensors are subjected to -65 ˚C and 125 ˚C for about 10 sec for every temperature

56. Results of Accelerated ageing test are interpreted for _____

   a. True accelerated age
   b. Valid extrapolation to obtain expected performance under normal condition
   c. Determining the acceleration factor for scaling
   d. All the above

57. Mechanical shock test is done by _____

   a. sensors are subjected to -65 ˚C and 125 ˚C for about 10 sec for every temperature

b. High stress is imposed on sensor – results are used to predict the performance in normalstressed condition

c. Progressively larger voltages up to 50% in excess are applied over different intervals of time

d. Dropping the unit from specified height (3 to 10m) or the unit is shaken by attaching it to a shaking table for a specified time.

58.Which of the following is not belongs to optical characterization parameters?

a. Absorption coefficient

b. Refractive index

c. Reflectivity

d. Torque

59. Which of the following is caused by careless handling?

a. Systematic Error

b. Random Error

c. Gross Error

d. None of the above

60. Which of the following error is caused by poor calibration of the instrument?

a. Random Error

b. Gross Error

c. Systematic Error

 d. Precision Error

61.The Unpredictable errors are called_____

a. Random error

b. Gross error

c. Systematic error

d. Precision error

62. Which method can reduce dynamic error?
a. By increasing accuracy
b. By increasing precession
c. By reducing sensitivity
d. By reducing time lag

63. _____is also used to indicate the most probable value of the measured

quantity when a set of readings are taken.

a.Mean

b.Median

c.mode

d.deviation

64._____ mainly covers the human mistakes in reading instruments and recording and calculating measurement results

a.Gross error

b. Instrumental Error

c. Random Error

d. Environmental Error

65."actual quantity is being measured is in one plane and the transducer is subjected to variations in another plane" is called

a. Accuracy

b. Resolution

c. Cross sensitivity

d. Stability

66.In For circular wire and circular jockey resistive potentiometers, the ratio of "radius of jockey" to "radius of wire" approximately equal to

a. 10
b. 25
c. 100
d. 50

67._____ sensors are utilised to measure variables such as point, velocity, acceleration, force, press, levels and flow.
a. Humidity
b. Optical
c. Thermal
d. Mechanical

68.The transducer should have a ---------------high input impedance and a ------------- low output impedance to avoid loading effects.

a. high input impedance, low output impedance

b. high input impedance, high output impedance

c.low input impedance, high output impedance

d.low input impedance, low output impedance

69. Mechanical transducer translate the ---------------deformation into a(n)----------- electrical signal

a. Mechanical, electrical

b.Electrical, mechanical

c.Electrical, electrical

d.Mechanical, pressure

70.Resistance of a metallic conductor is given by _____
a. $R = \frac{l}{A}$
b. $R = \frac{\rho}{A}$
c. $R = \frac{\rho l}{A}$
d. $R = \frac{l}{A}$

71.Rotational potentiometers use _____
a. capacitance
b. self inductance
c. mutual inductance
d. resistance

72.Electrical Strain Gauge works on the principle of _____
a. Variation of resistance
b. Variation of inductance
c. Variation of capacitance
d. Variation of area

73. Strain Gauge is ----------------

a. Passive device and converts electrical displacement into change of resistance

b. Passive device and converts mechanical displacement into change of resistance

c. Active device and converts electrical displacement into change of resistance

d. Active device and converts mechanical displacement into change of resistance

74.Which of the following can be measured using piezo electric transducer?

a. Velocity
b. Force
c. Displacement
d. Sound

75. ----------------- is based on principle of change in resistance of a metallic wire in response to strain produced.

   a. **Strain gauge**
   b. Sensors
   c. Transducers
   d. Signal conditioning circuits

76.------------------- and -----------------------are the classification of strain gauge

   a. **Semiconductor and resistance type**
   b. Semiconductor and inductance type
   c. Semiconductor and capacitance type
   d. Inductance and capacitance type

77.Which of the following is not a classification of resistance strain gauge

   a. Unbonded metal wire
   b. Bonded metal wire
   c. Bonded metal foil
   d. **Unbonded metal foil**

78.Which of the following is not an example for bonded strain gauges

   a. flat grid type,
   b. wrap around type
   c. woven type
   d. **Thin metal film by vacuum deposition type**

79. Which of the following is a type of Semiconductor Strain Gauges?

   a. **Diffused semiconductor**
   b. Bonded metal foil
   c. Thin metal film by vacuum deposition
   d. Thin metal film by sputter deposition

80.Strain is a _____

   a. Fractional change in Volume
   b. Fractional change in Area
   c. **Fractional change in length**
   d. fractional change in height

81 ._____strain gauge consists of a piece of wire stretched in multiple folds between a pair or more of insulated pins fixed to movable- members of a 'body' or even a single flexible member whose strain is to be measured.

   a. Thin metal film by vacuum deposition

b. Thin metal film by sputter deposition
c. Unbonded
d. Bonded

82. Considering a circular cross-section metal resistance wire of length l and cross-sectional area A with resistivity ρ of the material, the unstrained resistance of the wire is given by

a. $R = \rho/A$

b. $R = \rho l/A$

c. $R = \rho Al$

d. $R = \rho l + A$

83. Thermistor is a contraction of _____

e. Electric resistor
f. Laser resistor
g. Mechanical resistor
h. Thermal resistor

84. Which one the following is a temperature sensor?

a. **RTD**
b. Piezoelectric transducer
c. Differential transformer
d. strain gauge

85. RTD stands for_____

a. **Resistance Temperature Device**
b. Resistance Temperature Detector
c. Reluctance Thermal Device
d. Resistive thermal detector

86. Thermistor is used to measure _____

a. **Temperature**
b. Pressure
c. Height

87. Identify the transducer not used for the measurement of temperature.

a. Thermocouple
b. RTD
c. Thermistor
d. RVDT

91. Which one of the following is not an electrical characteristic of Transducers?
A) Impedance
B) Cross talk
C) Breakdown voltage

D) **Reliability**

88. RTD and Thermistors are _____ transducers.

a. active and analog
b. passive and analog
c. active and digital
d. passive and digital

89.In RTD, the variation of resistance of the metal with the variation of the temperature is given as
    a. $R_t = R_o[1 + (t - t_0)]$
    b. $R_t = R_o[1 * (t - t_0)]$
    c. $R_t = R_o[1 + (t + t_0)]$
    d. $R_t = R_o[1 + (t * t_0)]$

90. Temperature coefficient of thermistor is _____.
    a.   zero
    b.   positive or negative
    c.   negative
    d.   positive

PART-B

1.	Illustrate the different types of sensor static characteristics.
2.	Demonstrate about electrical characterization
3.	Discuss the dynamic characteristics of sensor.
4.	Explain briefly "semiconductor strain gauge" with their principle of operation
5.	(i)A platinum resistance RTD has a resistance of 120Ω at 25^{0}C. Determine the resistance at 75^{0}C. The temperature coefficient of resistance is 0.00392 at 25^{0}C. (ii) Distinguish the characteristics of RTD and thermistor
6.	(i).Describe the optical characterization of sensor. (ii) Summarize the applications of thermistors

PART-C

1.	Briefly describe sensors and classify it based on measurands and technology.
2.	Explain the working principles of RTD along with the necessary equations and its different types in detail.
3.	Describe the following transducers (a) Strain Gauge with its sensitivity (b) Thermistor
4.	Explain in detail about various types of errors associated in measurement and how these errors can be minimized
5.	Analyze the various mechanical and thermal characterization of sensor.
6.	With neat sketch explain the Resistive potentiometer and types.
7.	Describe the different criteria for selection of transducer for a particular application