Model paper

EL-203

Q.-1 Differentiate between active and passive transducer?

S.No.	Passive Instruments	S.No.	Active Instruments
1.	The output is produced entirely by the quantity being measured.	1.	The quantity to be measured activates some external power input source, which inturn produces the output.
2.	Additional energy input source not required.	2.	Additional external energy input source is required.
3.	The resolution is less.	3.	The resolution is high.
4.	The resolution can not be easily adjusted.	4.	The resolution can be adjusted by adjusting the magnitude of the external energy input.
5.	Simple to design.	5.	Complicated to design.
6	Cheaper hence economical.	6.	Due to complex design and higher number of elements, it is costlier.
7.	Examples are pressure gauge, voltmeter, ammeter.	7.	Examples are liquid level indicator, flow indicator.

Q.2 explain construction and type's of thermistor?

The word **Themistor** can be termed as Thermal Resistor. So as the name indicates it is a device whose resistance changes with the change of the temperature. Due to there high sensitivity they are widely used for the measurements of the temperature. They are usually called the Ideal Temperature Transducer.

Properties of Thermistors

- They have Negative Thermal Coefficient i.e. resistance of the thermistor decreases with increase in temperature. They are made up of the semiconductor materials.
- They are made sensitive than RTD (Resistance Thermometres Detector) and Thermocouples
- There resistance lies between 0.5Ω to 0.75Ω

They are generally used in applications where measurement range of temperature - $60^{o}C$ to $15^{o}C$

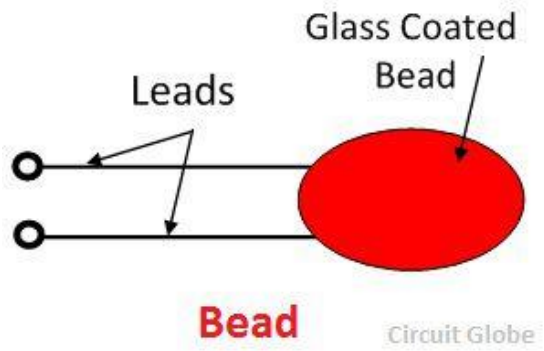
The thermistor is classified into types. They are the negative temperature coefficient and the positive temperature coefficient thermistor.

Negative Temperature Coefficient Thermistor – In this type of thermistor the temperature increases with the decrease of the resistance. The resistance of the negative temperature coefficient thermistor is very large due to which it detects the small variation in temperature.

Positive Temperature Coefficient Thermistor – The resistance of the thermistor increases with the increases in temperature.

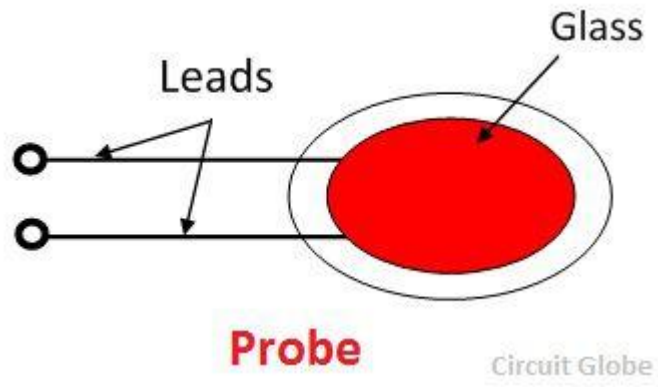
Construction of Thermistor

- **Thermistors** are generally composed of mixture of metallic oxides such as manganese, nickel, cobalt, copper etc.
- Smaller thermistors are in the form of beads of diameter from 0.15 millimeters to 1.5 millimeters.
- Thermistor may be in the form of disks and washers made by pressing thermistor material under high pressure into flat cylindrical shapes with diameter from 3 millimeters to 25 millimeters.



The bead form of the thermistor is smallest in shape, and it is enclosed inside the solid glass rod to form probes.

The disc shape is made by pressing material under high pressure with diameter range from 2.5 mm to 25mm.



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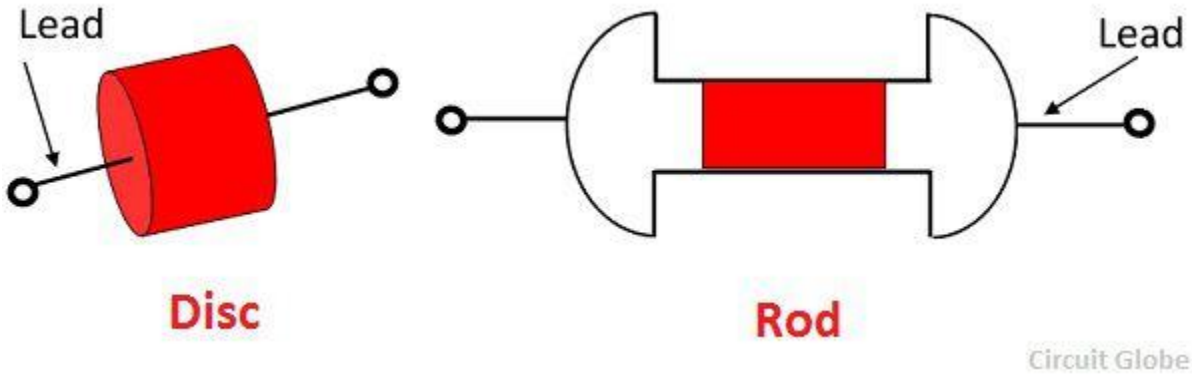
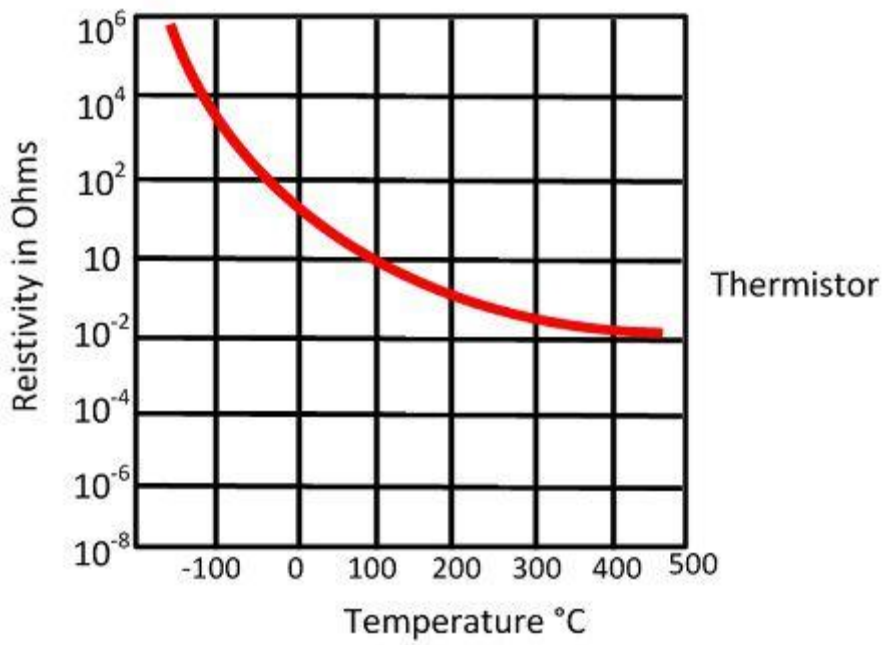


The relationship of the characteristics of thermistors is

Where R_{T1} – Resistance of the thermistor at absolute temperature T_1 in Kelvin.
R_{T2} – Resistance of the thermistor at absolute temperature T_2 in Kelvin.
B – a temperature depending on the material of thermistor.

$$R_{T1} = R_{T2} exp\left[\beta\left(\frac{1}{T_1} - \frac{1}{T_2}\right)\right]$$

The resistance temperature coefficient of the thermistor is shown in the figure below. The graph below shows that the thermistor has a negative temperature coefficient, i.e., the temperature is inversely proportional to the resistance. The resistance of the thermistor changes from 10^5 to 10^{-2} at the temperature between -100C to 400C.



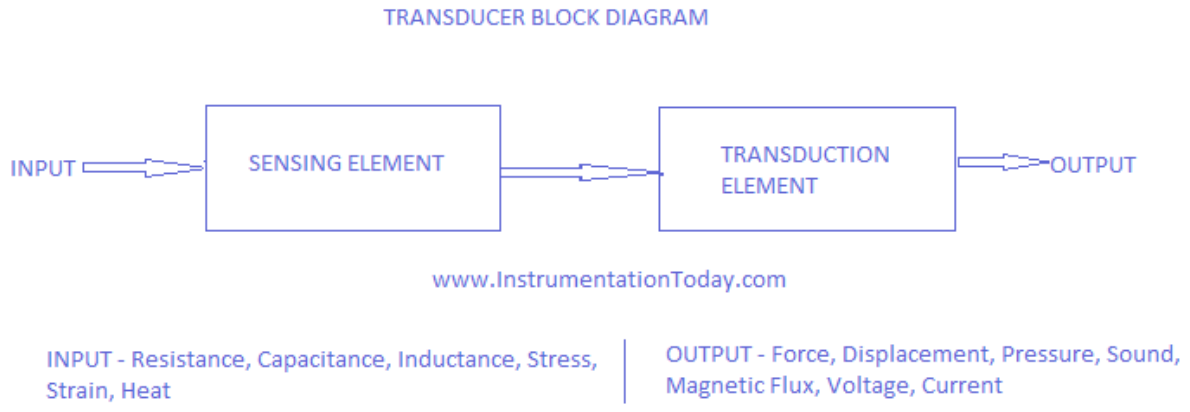
Resistance Temmperature Characteristic

Circuit Globe

Q.3 what is transducer. Classified them?

A transducer is a device that is used to convert a physical quantity into its corresponding electrical signal.

In most of the electrical systems, the input signal will not be an electrical signal, but a non-electrical signal. This will have to be converted into its corresponding electrical signal if its value is to be measured using electrical methods.



A transducer will have basically two main components. They are

1. Sensing Element

The physical quantity or its rate of change is sensed and responded to by this part of the transistor.

2. Transduction Element

The output of the sensing element is passed on to the transduction element. This element is responsible for converting the non-electrical signal into its proportional electrical signal.

There may be cases when the transduction element performs the action of both transduction and sensing. The best example of such a transducer is a thermocouple. A thermocouple is used to generate a voltage corresponding to the heat that is generated at the junction of two dissimilar metals