Hello students.

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Today we will be covering Unit 2: Transducers and the name of the

module is temperature transducer,.

Thermocouple thermistor and RTD.

The model number is 16.

The outline of this module is as follows. Temperature

transducer resistance temperature detector called as

RTD, thermocouple and thermistor.

Through this model, the students will be able to

define a temperature transducer.

Explain the working principle of a resistance temperature

detector. Explain the working principle of a thermocouple

and explain the working principle of a thermistor.

Let us begin with our module.

Temperature transducer is a device used to monitor

and control temperature.

There are different types of

temperature transducer. Named as resistance temperature detector

called as RTD.

Thermistor and thermocouple.

RTD and thermistor are passive devices whose resistance changes

with temperature. Hence they need a electrical supply to give

a voltage output.

whereas thermocouple is an active transducer and is based

on the principle of generation of Thermoelectricity.

Now the first temperature transducer, what will be

covering is resistance

temperature detector. This device has a positive

temperature coefficient. It means as temperature increases,

the resistance also increases.

The relationship between the temperature and resistance of a

conductor in the temperature range near 0 degrees is given

by RT is equal to R reference multiply by bracket

one plus Alpha Delta T.

Where Rt is resistance of the conductor at temperature

T degrees.

And R reference is the resistance of the conductor at

reference temperature 0 degrees.

Alpha is the temperature coefficient of the resistance.

Delta T is the difference between the operating and

reference temperature, so this is the formula for RTD.

Temperature transducer. A high value of Alpha is required in

a temperature sensing element to produce sufficient change

in resistance for small changes in temperature.

The most widely used material is platinum and nickel.

Now, the advantages of using a resistance temperature detector

R. It is having a very good

linearity. It is having a wide

operating range. and Temperature operation is

very very high.

And the very important thing it is having good accuracy and

stability at high temperatures. So it is often

used for industrial applications.

The disadvantage of an RTD is it is having a very low

sensitivity. It can be affected by the contact

resistance, shock and vibration.

Its response time is very very

slow. And it is very expensive compared to other temperature

transducers. This will be

discussing later. Now the second type of a temperature can do.

is a thermocouple.

In this two dissimilar metal wires are joined together to

form 2 junctions.

One junction is called as a sensing junction. Also called

is a hot junction and the other junction is called as a

cold junction, also called as reference Junction.

So whenever there is a temperature difference between

two junctions, a small EMF is developed in the circuit.

And the current flowing through the circuit is called as Thermo

Electric current. And this effect is called a Seebeck

effect. So this is the working principle of a Thermocouple.

Now the magnitude of the voltage depends on the material used for

the wires and also depends on the amount of temperature

difference between the two ends.When I say two ends means Hot

Junction and cold junction.

Thermocouples are connected in series or in parallel to obtain

greater sensitivity. And this is called a thermopile.

Now the advantage of using a thermocouple is it is having a

very rugged construction.

Its operating temperature is

very wide. It is cheaper compared to other temperature

transducers, and the accuracy is very very good. The plus point of a thermocouple is the speed response is very high compared to your RTD.

Now there are some disadvantages in the thermocouple.

Cold Junction and other compensation is vert very important to estimate accurate temperature.

There's non linearity with respect to voltage and temperature. And the amount of voltage produced by your thermocouple is very very small, and therefore the signals has to be amplified.

The third temperature transducer is a thermistor.

A thermistor is a thermally sensitive resistor whose electrical resistance varies according to its temperature.

Thermistors are non metallic resistors made by sintering mixtures of metallic oxides.

Such as manganese.

Nickel cobalt, copper which exhibit a negative temperature coefficient. Negative temperature coefficient means as temperature increases, the resistance decreases. But there are also thermistor, which are PTC. But this particular PTC thermistors are having very low

sensitivity, so that is why they are not often used.

Thermistors are available in various sizes and shapes.

Such as in a form of Bead type.

It can be in the form of rod type. It can be in the form of

disk type or it can be of washers and the last It

can be in the form of probes.

The advantage of using a rod thermistor over other

configuration is the ability to produce high resistance

unit with moderately high power handling capability.

So when you want to measure any

temperature. You need to connect the thermistor or RTD in the

form of a arm, so you'll often use this as one arm of your wheat

stone bridge. So when the Wheatstone Bridge is balanced.

The output voltage will be zero.

So whenever there is a change in temperature, the bridge remains

unbalanced, which will give you the output which is

corresponding with change in

temperature. Now the advantage of using a thermistor is.

It is very small in size and it is having low cost.

It is having a very fast response over narrow temperature

range. It is having good sensitivity in the NTC region.

You don't require cold compensation, and there is no

issues with regards to contact and lead resistance.

The disadvantage of a thermistor is the output is nonlinear.

It is not suitable for wide

temperature range. And it is having a very low excitation

current to avoid self heating.

So in this particular module,what we have learned is three

different types of temperature transducers, named as

resistance, temperature

detector. Thermocouple and

thermistor. These are my references and with this we come

to the end of the module.