I am Caje Francis Pinto.

Assistant Professor from Department of Electronics at St Xavier's College Mapusa goa. So today we are going to be doing unit 2 transducers and the module name is strain gauges. The module number is 9. So the outline is as follows. Will be doing strain gauge, gauge factor resistance wire strain gauge. Unbounded resistance wire strain gauge. Bonded Resistance wire strain gauge foil strain gauge. And Semiconductor strain gauge. Through this module, the student will be able to explain the working of a strain gauge, define and measure the value of gauge factor. Explain the working of a wire strain gauge. Foil strain gauge. And semiconductor strain gauge. And at last compare the different types of strain gauges. So students we shall begin with the topic. Strain gauge is a device whose resistance varies with applied force. It is used to convert force, pressure, tension,

weight etc into a change in electrical resistance. If a metal conductor is stretched or compressed, both its length and diameter of the conductor changes. Thereby changing its resistance. Also, there is a change in the value of resistivity of the conductor when subjected to strain. Therefore, resistance strain gauges are also known as Piezo resistive gauges. An example when a gauge is subjected to positive strain, it is its length increases while its area of cross section decreases, thereby changing increasing the resistance of gauge. It is used for measuring weight, mechanical force or displacement. So the next subtopic we're going to be covering up is gauge factor. The measurement of the sensitivity of a material is called as gauge factor. In other words. The ratio of change in resistance to the change in length is called as gauge factor. The formula is shown as below.

Gauge factor GF is equal to.

Delta R upon R divided by Delta L upon L. where Delta R is the change in resistance in Ohms. R is the initial resistance in Ohms without strain, and Delta L is a change in length in meters. L is the initial length in meters without strain, so you can find out the gauge factor of any material. There are three types of strain gauges. The first one is called as a wire strain gauge in resistance wire strain gauge. There are two types. Unbonded resistance wires strain gauge. And the second one is bonded resistance wire strain gauge. The second type is called as foil strain gauge, and the third one is called a semiconductor strain gauge. We shall go into details of unbonded resistance wire strain gauge, so in an unbounded wire strain gauge the wire is stretched between two points in the insulating medium. That is the fixed base. And the movable arm. So over here the strain gauge is connected to the unknown arm of the bridge circuit and the bridge is

balance. So when an external load is applied, the resistance

of the strain gauge changes, causing an unbalanced in the bridge circuit, thereby producing an output voltage which is proportional to the strain applied. So this is the working principle of the unbounded resistance wire strain gauge. Now we shall be looking into the bonded resistance wire strain gauge. In this particular example, the fine wire is looped back and forth on the supporting base, which is also called as a carrier is attached to the member undergoing stress. The base or carrier is a thin sheet of paper, bakelite or Teflon. So whenever stress is applied to the Member, the wire stretches, increasing its length and decreasing its area of cross section, thereby increasing its resistance. So over here this is the working principle of a bonded resistance wire strain gauge, so now coming into the second type which is called as a foil strain gauge. In foil strain gauge it is using metal foils like nichrome, platinum and nickel. Over here, the strain sensitive material is bonded to the thin sheet of paper or bakelite. The portion of the metal

which is required is covered with the masking material. An

etching solution is applied to the unit. The solution is used to remove the unmasked portion leaving the desired grid structure intact. So this is how a foil strain gauge looks like and this entire thing what you see in the red color one is the edge metal foil strain.

So coming to the advantages of coil wire strain gauge, it is having a greater dissipation capacity than a wirewound gauges because for the same, you have most surface area for the same given volume. It can be fabricated on the large scale. Can be made of any shape. You Can also make thinner strain gauge and it has more flexibility. The disadvantage of a coil wire gauge is it is having less gauge factor, so a foil wire gauge and wire gauge both of them have the same gauge factor. Now coming to the next semiconductor strain gauge in this semiconductor strain gauge. You have to have a high value of sensitivity and to have high value of sensitivity you need to have a high value of gauge factor. So that means the change of resistance per strain has to be very very high.

So depending upon the piezoresistive effect, the

change in the value of resistance due to the change in resistivity is important, but when it comes to metallic gauges, the change in resistance is only due to the change in dimension when strain. the material which is used over here what you can see in red color is semiconductor material, so that is Silicon or germanium. The one what you see in Golden Color is made of golden leads. So the both the ends of the leads are connected to electrodes. So this is the working principle of a semiconductor strain gauge. So coming to the advantages and disadvantages of a strain gauge. It is also having excellent hysteresis characteristics. When You say about hysteresis is how much value is differing from the original resistance after it comes back to its original position. The strain gauges are small in size. The value of the the length of the strain gauge is around .7 to 7 millimeter. The disadvantage of semiconductor strain gauge is it is sensitive to changes in temperature. Its Linearity is poor and it is very very expensive.

So in this module, what we have learned is we have studied about

the strain gauge we have learned about the different types of

strain gauges and the working

principle of wire type, foil type and a semiconductor

type. Thank you.

These are my references.