UNIT 4

1) What is transducer ? Write one example of active & passive transducer

A **transducer** is **an** electronic device that converts energy from **one** form to **another**.

Basis For Comparison	Active Transducer	Passive Transducer
What is	The transducer which generate the output in the form of voltage or current, without any external energy source is known as active transducer.	The passive transducer means the transducer whose internal parameters like capacitance, resistance & inductance changes because of the input signal.
Additional Energy Source	Not Require	Require
Working Principle	Draw energy from the measurand source.	Take power from the external source which changes the physical properties of transducer.
Design	Simple	Complicated
Resolution	Low	High
Output signal	Produces from the signal to be measured.	Output obtains by receiving the signal from the external power source.
Examples	Tachogenerator, Thermocouple, Photovoltaic cell etc.	Thermistor, Differential transformer, Photomultiplier tube, Photovoltaic cell.

2) Define Primary & secondary transducer & give one example of each.

Primary transducer

Definition:

The transducer which converts physical quantity into mechanical displacement is called primary transducer.

• The force detected by the column in first. Hence it is called primary transducer.

• It is a mechanical device.

Example:

• Bourdon Tube

• Diaphragm

• Bellows

Secondary transducer

Definition:

The transducer which converts mechanical displacement into electrical output is called secondary transducer.

• Output of primary transducer is converted into useful signal by secondary transducer.

• It is an electrical device.

Example:

• LVDT

3) Classify each of the following transducers in two different categories:
i) LVDT-(electromechanical displacement passive transducer)ii) Strain Gauge (sensor - active transducer)

4) Write the Advantages & Disadvantages of L.V.D.T

Benefits or advantages of LVDT Transducer

Following are the benefits or **advantages of LVDT Transducer**:

- It has high measurement range which is from 1.25 mm to 250 mm.
- It has low power consumption which is less than about 1 Watt.
- It is frictionless device.
- It offers high resolution which is greater than 10 mm.
- Higher sensitivity of greater than 40 V/mm can be achieved.
- It is smaller in size.
- It is less in weight.
- It has lower hysteresis.
- It is solid and robust in construction. Hence it is tolerant to shocks and vibrations.
- It has excellent repeatability.
- It has very low output impedance.

Drawbacks or disadvantages of LVDT Transducer

Following are the **disadvantages of LVDT Transducer**:

- Large displacement is needed for small output.
- It is affected due to external magnetic field and hence the entire LVDT circuit need to be shielded to achieve desired accuracy.
- Vibrations due to displacement can affect the performance of the LVDT device.
- The performance of LVDT is affected due to increase in temperature.
- In order to get DC output, external demodulator is required.
- It has limited dynamic response.

5) What is piezoelectric effect? Name two piezoelectric materials.

Piezoelectric Effect is the ability of certain materials to generate an electric charge in response to applied mechanical stress.Some examples of piezoelectric materials are PZT (also known as lead zirconate titanate), barium titanate, and lithium niobate. These man-made materials have a more pronounced effect (better material to use) than quartz and other natural piezoelectric materials.

6) Write the parameter measured by:
i) LVDT(r measures a displacement up to 20 mm and it provides an output as a number between 1 and 100 then the resolution of the sensor device is 0.2 mm)
ii) Piezoelectric Transducer (is capable to detect pressures between 0.1 and 10,000 psig (0.7 KPa to 70 MPa)
II) Linear & angular Potentiometer (linear and angular displacement)
v) Diaphragm (to measure the inlet manifold pressure in applications such as automobiles. A typical arrangement of strain gauges on a diaphragm)

7) Explain the construction & working of LVDT.

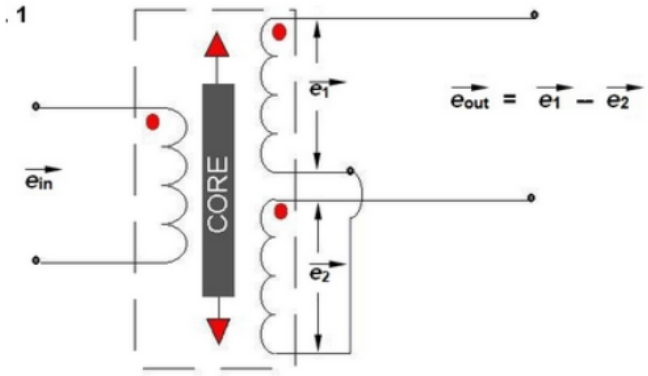
- The transformer consists of a primary winding P and two secondary windings S_1 and S_2 wound on a cylindrical former (which is hollow in nature and contains the core).
- Both the secondary windings have an equal number of turns, and we place them on either side of primary winding
- The primary winding is connected to an AC source which produces a flux in the air gap and voltages are induced in secondary windings.
- A movable soft iron core is placed inside the former and displacement to be measured is connected to the iron core.
- The iron core is generally of high permeability which helps in reducing harmonics and high sensitivity of LVDT.
- The LVDT is placed inside a stainless steel housing because it will provide electrostatic and electromagnetic shielding.
- The both the secondary windings are connected in such a way that resulted output is the difference between the voltages of two windings.

Principle of Operation and Working

As the primary is connected to an AC source so alternating current and voltages are produced in the secondary of the LVDT. The output in secondary S_1 is e_1 and in the secondary S_2 is e_2. So the differential output is,

$$e_{out} = e_1 - e_2$$

This equation explains the **principle of Operation of LVDT**.



Now three cases arise according to the locations of core which explains the working of LVDT are discussed below as,

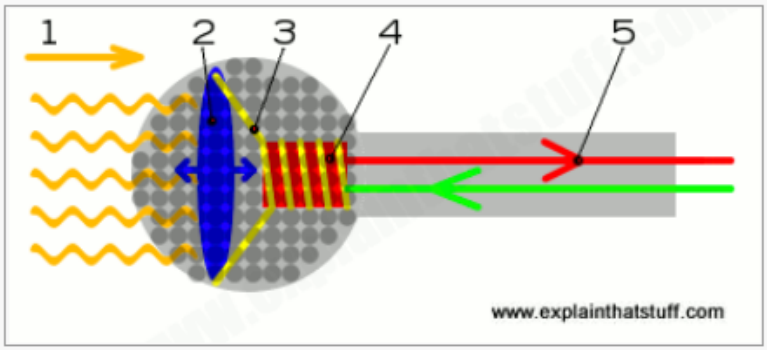
- CASE I When the core is at null position (for no displacement)
  When the core is at null position then the flux linking with both the secondary windings is equal so the induced emf is equal in both the windings. So for no displacement the value of output e_{out} is zero as e_1 and e_2 both are equal. So it shows that no displacement took place.
- CASE II When the core is moved to upward of null position (For displacement to the upward of reference point)
  In the this case the flux linking with secondary winding S_1 is more as compared to flux linking with S_2. Due to this e_1 will be more as that of e_2. Due to this output voltage e_{out} is positive.
- CASE III When the core is moved to downward of Null position (for displacement to the downward of the reference point). In this case magnitude of e_2 will be more as that of e_1. Due to this output e_{out} will be negative and shows the output to downward of the reference point.

8) Explain the construction & working of piezoelectric type transducer
9) Explain the construction & working of capacitive transducer
10) Differentiate between passive and active transducers. Give an example of each
11) Compare and explain static and dynamic characteristics of transducers
12) Explain the classification of transducers.
13) Compare capacitive and inductive transducers
14) Elaborate the applications of inductive transducers.
15) Explain the working of capacitive transducer with neat schematic.
16) Define Piezoelectric principle and explain the working of piezoelectric transducer.
17) What is the principle of Piezoelectric transducer? The main **principle** of a **piezoelectric transducer** is that a force, when applied on the quartz crystal, produces electric charges on the crystal surface. ... As the charge produced is very small, a charge amplifier is needed so as to produce an output voltage big enough to be measured.
18) With a neat schematic explain the working of the following
    (i) Mic

How microphones work

How does a microphone turn sound energy into electrical energy? Like this:

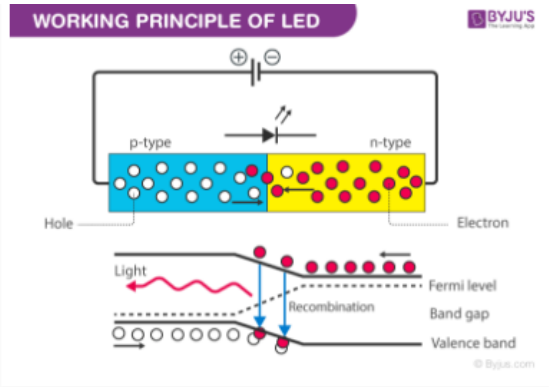
1. When you speak, **sound waves** created by your voice carry energy toward the microphone. Remember that sound we can hear is energy carried by vibrations in the air.



2. Inside the microphone, the **diaphragm** (much smaller than you'd find in a loudspeaker and usually made of very thin plastic) moves back and forth when the sound waves hit it.
3. The **coil**, attached to the diaphragm, moves back and forth as well.
4. The **permanent magnet** produces a magnetic field that cuts through the coil. As the coil moves back and forth through the magnetic field, an electric current flows through it.
5. The **electric current** flows out from the microphone to an amplifier or sound recording device. Hey presto, you've converted your original sound into electricity! By using this current to drive sound recording equipment, you can effectively store the sound forever more. Or you could amplify (boost the size of) the current and then feed it into a loudspeaker, turning the electricity back into much louder sound. That's how PA (personal address) systems, electric guitar amplifiers, and rock concert amplifiers work.

(ii) Speaker (iii) Sonar (iv) Ultrasonic

19) Explain the working of LED



The figure demonstrates the elementary process principle

When this movement of free electron and hole takes place, there is a change in the energy level as the voltage drops from the conduction band to the valance band. There is a release of energy due to the motion of the electron. In standard diodes, the release of energy in the manner of heat. But in LED the release of energy in the form of photons would emit light energy. The entire process is known as electroluminescence, and the diodes are known as a light-emitting diode.

In LED, energy discharged in light form hinges on the forbidden energy gap. One could manipulate the wavelength of the light produced. Therefore, from its wavelength, the light color and its visibility or cannot be controlled. The color and wavelength of the light emitted can be determined by doping it with several impurities.

Basis For Comparison	LED	LCD
Definition	PN-Junction device which discharge visible lights when an electrical charge passes through it.	It is an optical device used for displaying the information in the form of text and images.
Stand For	Light Emitting Diode	Liquid Crystal Display
Backlight	No backlight	Cold cathode fluorescent lamp provides backlight.
Resolution	High	Low
Power Requirement	More	Less
Display Area	Small	Large
Cost	High	Low
Material	Gallium arsenide phosphide.	Liquid crystals and glass electrodes.
Switching Time	Fast	Slow
Direct Current	Do not effects.	Reduces Life Span
Contrast Ratio	Low	High
Mercury	Not used	Used

20) Differentiate LED and LCD

21) What is Thermocouple? A **Thermocouple** is a sensor used to measure temperature. **Thermocouples** consist of two wire legs made from different metals. The wires legs are welded together at one end, creating a junction. This junction is where the temperature is measured. When the junction experiences a change in temperature, a voltage is created.

22) Explain with a neat schematic about Thermistor.

23) Explain Geiger Muller Tubes, Hall effect

A Geiger counter (Geiger-Muller tube) is a device used for the detection and measurement of all types of radiation: alpha, beta and gamma radiation. Basically it consists of a pair of electrodes surrounded by a gas. The electrodes have a high voltage across them. The gas used is usually Helium or Argon. When radiation enters the tube it can ionize the gas. The ions (and electrons) are attracted to the electrodes and an electric current is produced. A scaler counts the current pulses, and one obtains a ”count” whenever radiation ionizes the gas

24) with a neat diagram explain the operation of antenna.

25) Explain in a detailed way about transmitter and receiver with a block diagram

Unit 5

Digital systems

1. Define Minterm and Maxterm.

2. Give the limitations of K-Map.

3. Obtain the canonical SOP form of the function Y(A, B, C, D)=AB+ACD.

4. Simplify the boolean expression using K-Map F= AB'C+A'B'C+A'BC+AB'C'+A'B'C'.

5. Simplify (A+B)(A'C'+C)(B'+AC)' using Boolean expression

6. Simplify using K-Map F(A,B,C)= Σ m(0,2,3,6,7)

7. Simplify using K-Map F(A,B,C,D)= Σ m(0,2,3,6,7) + d(8,10,11,15)

8. F (w, x, y, z) = ∑m (0, 7, 8, 9, 10, 12)+ ∑d (2, 5, 13)

9. Simplify F= (xy + y'z + xz)x using Boolean expression.

10 Convert $(143)_{10}$ to binary form.

11. Convert $(EC8)_{16}$ to binary form.

12. Convert $(220)_{10}$ to hexadecimal form.

13. What is the necessity of modulation?

14. Define amplitude modulation and draw its waveform.

15 Define frequency modulation and draw its waveform