

GOVERNMENT POLYTECHNIC COLLEGE BHILWARA

II MID TERM: 15<sup>TH</sup> February 2018

II- Year Electronics

Maximum Marks: 15

EL-203: Electronic Measurements and Instrumentation

All Questions are compulsory/ सभी प्रश्न अनिवार्य हैं

1. Explain the Ultrasonic method for level measurement [3 marks]
2. What do you understand by Electromagnetic Flow meter [3 marks]
3. Explain the functioning of an LVDT [ 3 marks]
4. What is a Strain Guage? Name the different types of strain gauges. [ 3 marks]

OR

Derive the relation for the Guage Factor of a Strain Guage?

5. What is a Potentiometer? What are the different types of Potentiometers [3 marks]

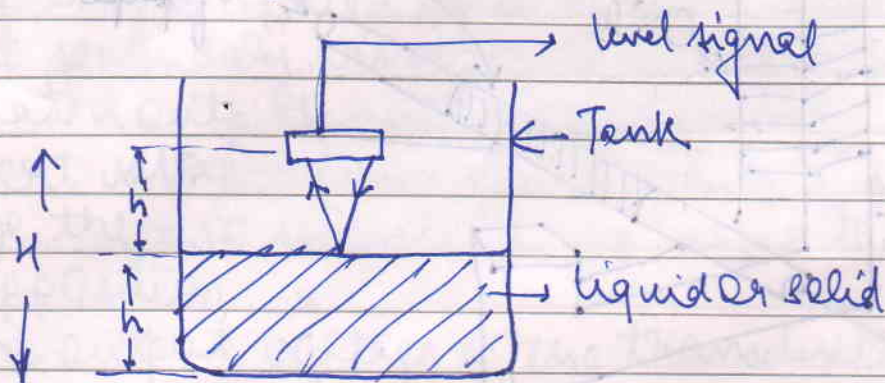
OR

Calculate the output voltage for a Potentiometer. What are the advantages and disadvantages of Resistance Potentiometer?

## II Mid-Term (Electronics)

### EL-203 (Electronic Measurements & Instru.)

#### ① Ultrasonic Method for level measurement



→ In this method an ultrasonic transmitter-receiver is mounted on top of tank for measurement of level

→ The beam is sent down by the transmitter and gets reflected by the surface of solid or liquid. This beam is received by the receiver.

→ The time taken by the beam gives the distance travelled by the beam. So, the time between transmitting and receiving the pulse is proportional to the distance ' $h$ ' between the transmitter and surface of the liquid.

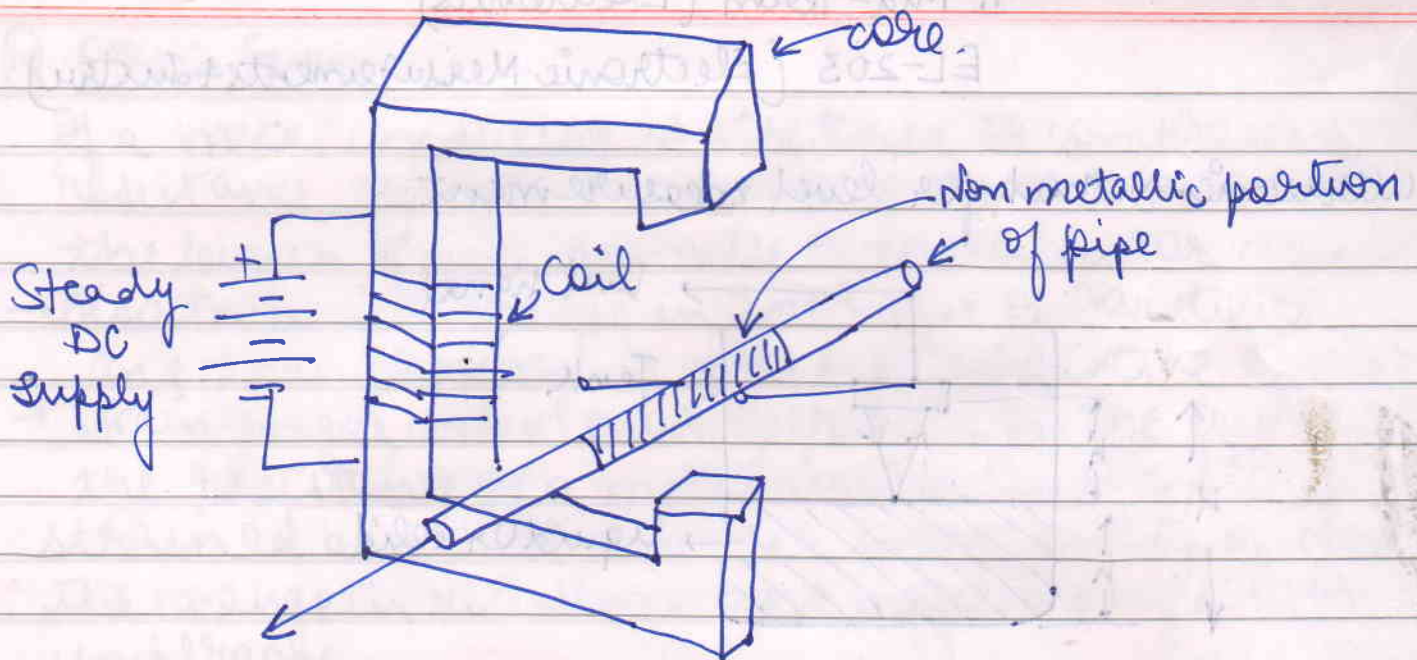
$$t \propto h'$$

$$\text{or } t \propto (H-h)$$

#### ② Electromagnetic Flow Meter

→ This method is used for flow measurement of any electrically conducting liquid, sludge, slurries, etc.

→ The flow meter is made up of a pair of insulated electrodes



→ The electrodes are on opposite sides of a non conducting, non magnetic pipe carrying the liquid whose flow is to be measured.

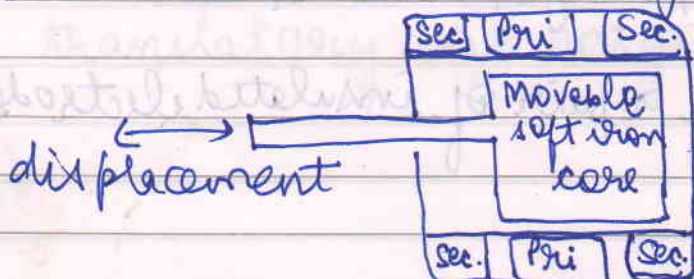
→ The pipe is surrounded by an electromagnet which produces a magnetic field. Due to the magnetic field a voltage is induced across the electrodes. This voltage is given by

$$E = B \cdot l \cdot v \text{ volts}$$

Flux density      length of conductor      velocity of liquid flow.

→ If there is a constant magnetic field, the voltage appearing across the electrodes will be directly proportional to velocity.

### ③ LVDT (Linear Variable Differential Transducer) Construction and Working



In WDT the displacement to be measured is applied to the arm attached to the soft iron core.

→ The frequency of applied AC is between 20 - 50 Hz

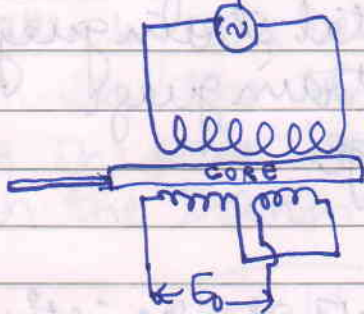
→ Let the secondary windings be  $S_1$  and  $S_2$ , and the associated output voltages be  $E_{S_1}$  and  $E_{S_2}$ . In order to convert voltages from  $S_1$  and  $S_2$  into a single output voltage the two secondaries are connected in series opposition.

→ Thus the output voltage of the transducer is the difference of the two voltages  
Differential output voltage

$$E_o = E_{S_1} - E_{S_2}$$

→ When the core is at null position, the flux linkage with both the secondary windings is equal and hence equal emfs are induced in them.

Thus, at null position.  $E_o = 0$  (since  $E_{S_1} = E_{S_2}$ )



If the core is moved to the left of null position more flux links with  $S_1$  and less with  $S_2$ . Therefore output voltage  $E_o = E_{S_1} - E_{S_2}$  is in phase with primary voltage.

→ Similarly when core is to the right of null position the output voltage with primary voltage.

#### ④ Strain Gauge

If a metal conductor is stretched or compressed, its resistance changes on account of the fact that both the length and diameter of the conductor changes → also there is a change in the value of resistivity and this property is called piezoresistive effect.  
→ Strain gauges based their operation on the fact that the resistance of a metal increases when it is strained and that a linear proportionality exist between the change in resistance and magnitude of strain undergone.

#### Different Types of Strain Gauge

- ① unbonded metal strain gauge
- ② Bonded metal wire strain gauge
- ③ Bonded metal foil strain gauge
- ④ Vacuum deposited thin metal film strain gauge
- ⑤ Sputter deposited thin metal strain gauge
- ⑥ Bonded semiconductor strain gauge
- ⑦ Diffused metal strain gauge

#### ⑤ Potentiometer

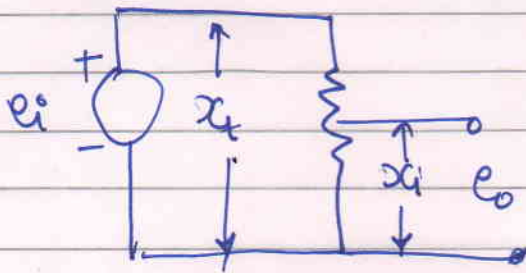
A resistance potentiometer consists of a resistive element provided with a sliding contact. This sliding contact is called a wiper.

The motion of the sliding contact may be translatory or rotational.

→ Some pots use the combination of both motions, translatory and rotational.

## Translational Resistive Devices

These devices have a stroke of 2 mm to 0.5 mm

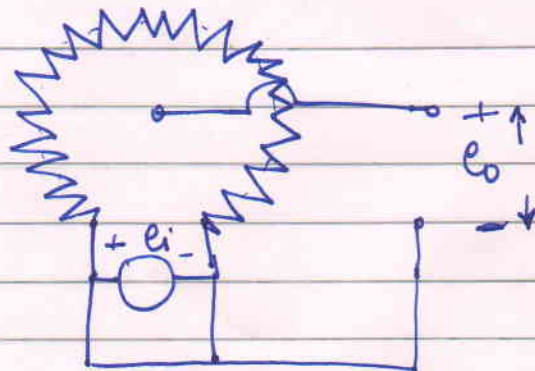


## Rotational Resistive Devices

These devices are circular in shape

They are used for the measurement of angular displacement

→ They have full scale angular displacement as small as  $10^\circ$



Multiturn potentiometers may measure upto  $3500^\circ$  of rotation through the use of Helipets

QdF  
(P. D. Upadhyay)  
Electronics