

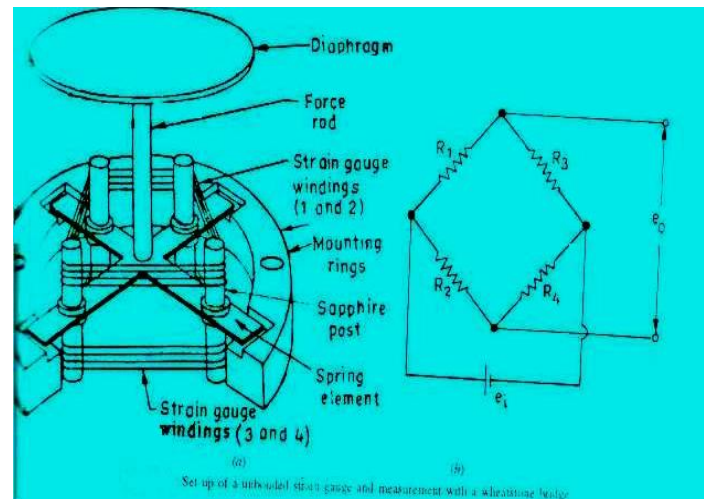
EIPC  
NEE-403  
Unit-1  
TRANSDUCERS

# PRIMARY AND SECONDARY TRANSDUCERS

- Some transducers contain the mechanical as well as electrical device. The mechanical device converts the physical quantity to be measured into a mechanical signal. Such mechanical device are called as the primary transducers, because they deal with the physical quantity to be measured.
- The electrical device then convert this mechanical signal into a corresponding electrical signal. Such electrical device are known as secondary transducers.

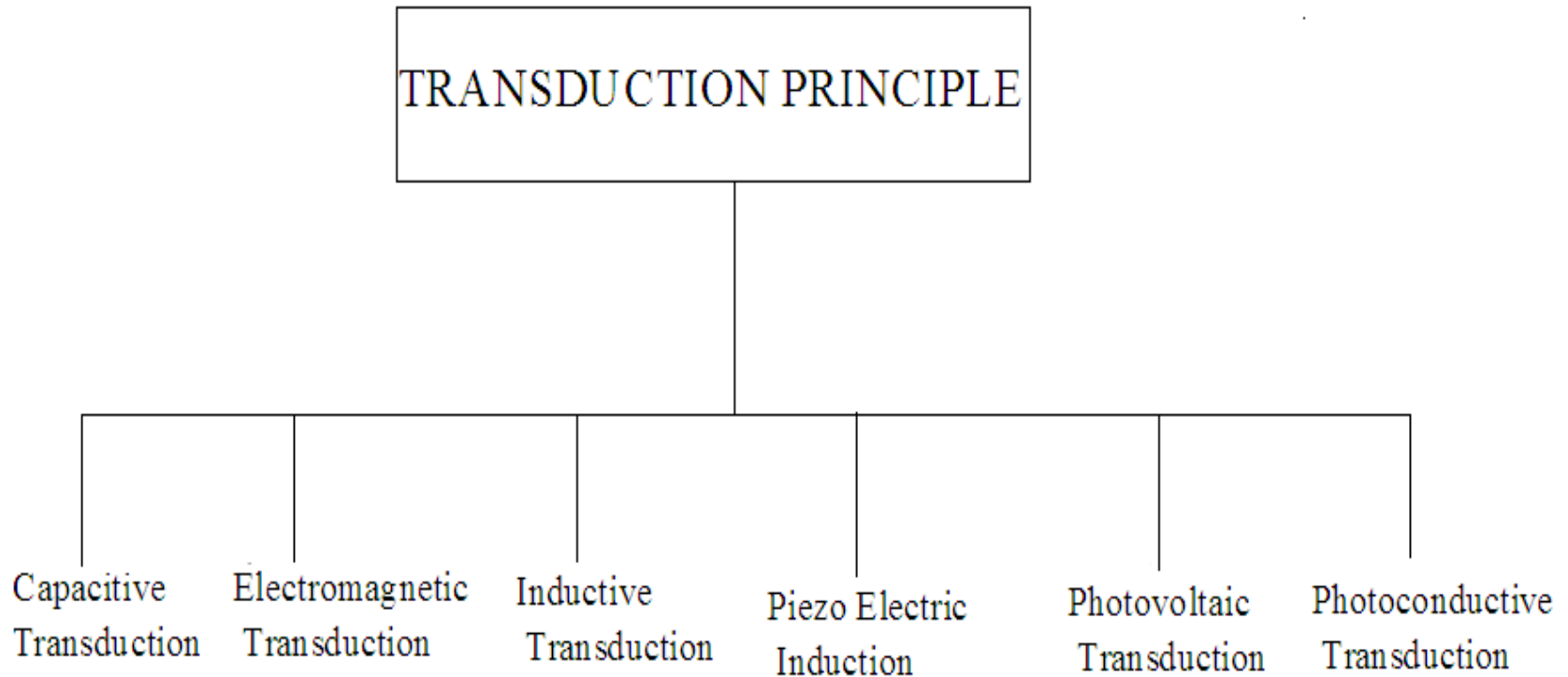
# Contd.....

- Ref fig in which the diaphragm act as primary transducer. It convert pressure (the quantity to be measured) into displacement(the mechanical signal).
- The displacement is then converted into change in resistance using strain gauge. Hence strain gauge acts as the secondary transducer.



# CLASSIFICATION OF TRANSDUCERS

## According to Transduction Principle



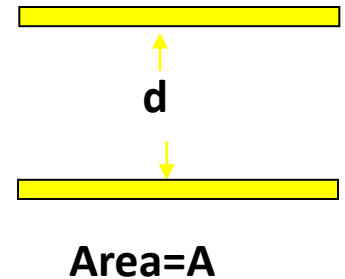
## CAPACITIVE TRANSDUCER:

- In capacitive transduction transducers the measurand is converted to a change in the capacitance.

- A typical capacitor is comprised of two parallel plates of conducting material separated by an electrical insulating material called a dielectric. The plates and the dielectric may be either flattened or rolled.

- The purpose of the dielectric is to help the two parallel plates maintain their stored electrical charges.

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- The relationship between the capacitance and the size of capacitor plate, amount of plate separation, and the dielectric is given by

- $C = \epsilon_0 \epsilon_r A / d$

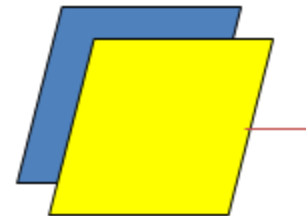
- $d$  is the separation distance of plates (m)

- $C$  is the capacitance (F, Farad)

- $\epsilon_0$  : absolute permittivity of vacuum

- $\epsilon_r$  : relative permittivity

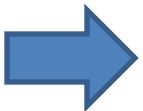
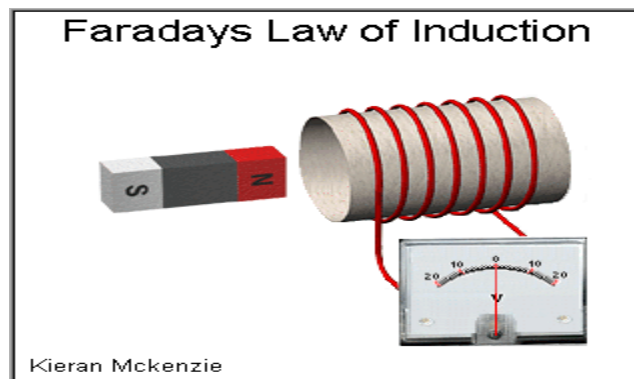
- $A$  is the effective (overlapping) area of capacitor plates ( $m^2$ )

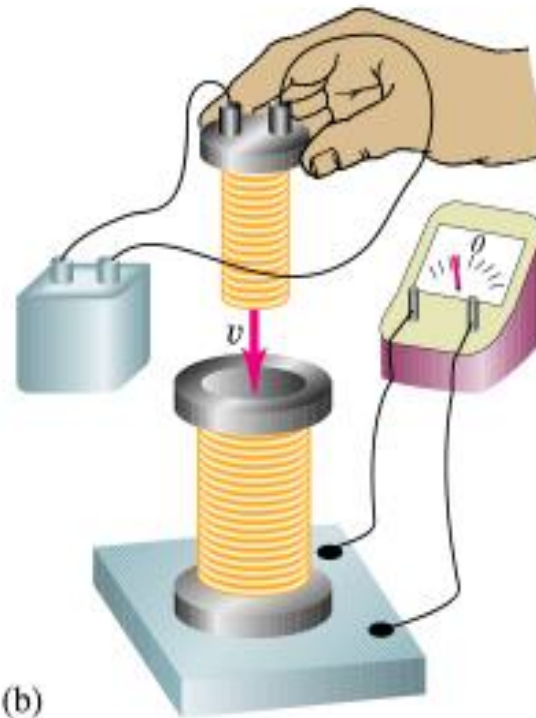
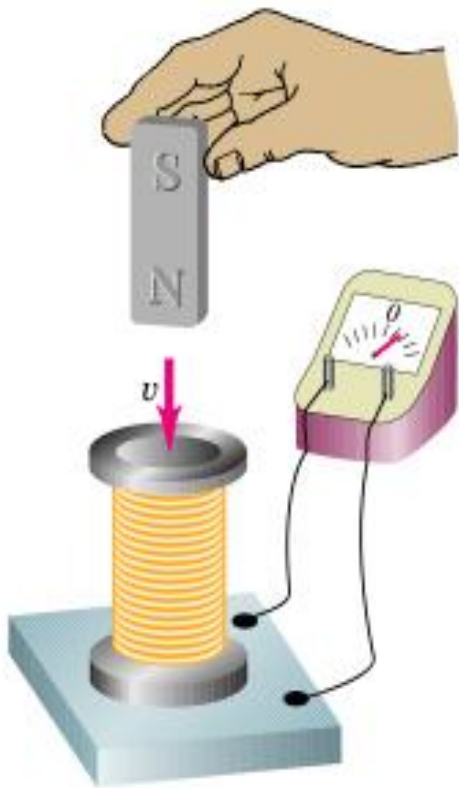


Either  $A$ ,  $d$  or  $\epsilon$  can be varied.

## **ELECTROMAGNETIC TRANSDUCTION:**

- In electromagnetic transduction, the measurand is converted to voltage induced in conductor by change in the magnetic flux, in absence of excitation.
- The electromagnetic transducer are self generating active transducers
- The motion between a piece of magnet and an electromagnet is responsible for the change in flux





(a)

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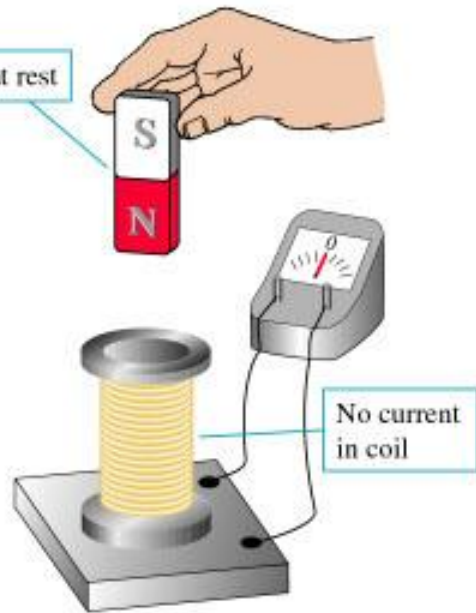
(b)

(c)

**Current induced in a coil.**

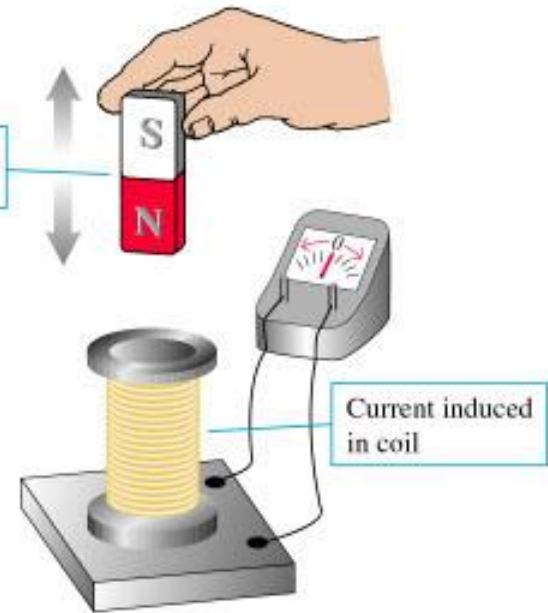


Magnet at rest



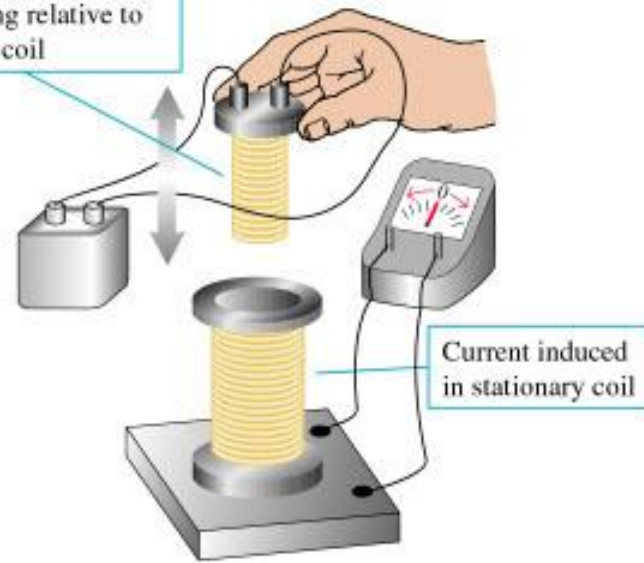
(a)

Magnet moving relative to coil



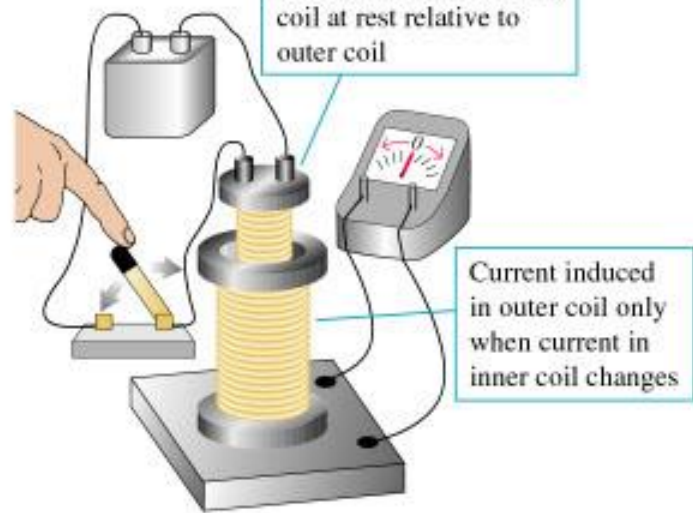
(b)

Second, current-carrying coil moving relative to stationary coil



(c)

Second, current-carrying coil at rest relative to outer coil



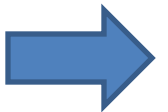
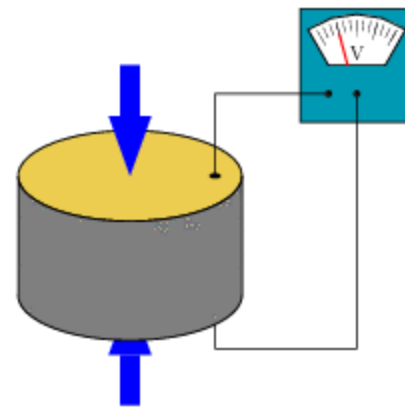
(d)

## **INDUCTIVE TRANSDUCER:**

- In inductive transduction, the measurand is converted into a change in the self inductance of a single coil. It is achieved by displacing the core of the coil that is attached to a mechanical sensing element

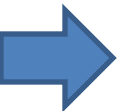
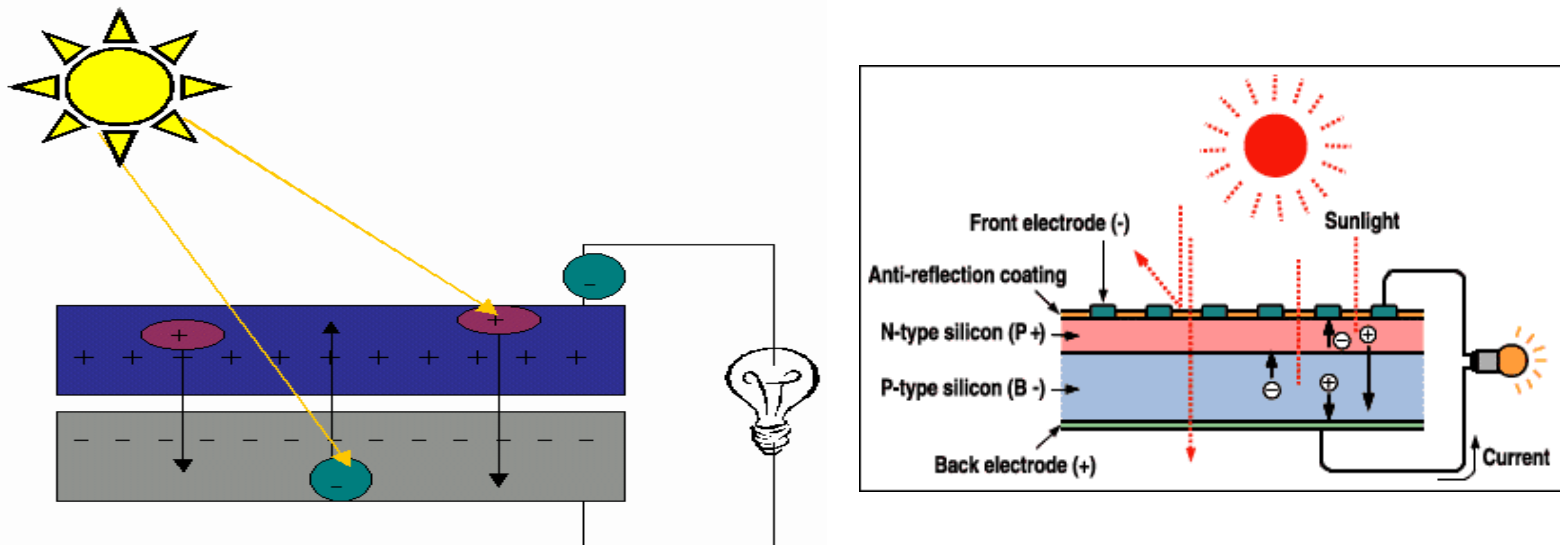
## PIEZO ELECTRIC INDUCTION :

•In piezoelectric induction the measurand is converted into a change in electrostatic charge  $q$  or voltage  $V$  generated by crystals when mechanically it is stressed as shown in fig.

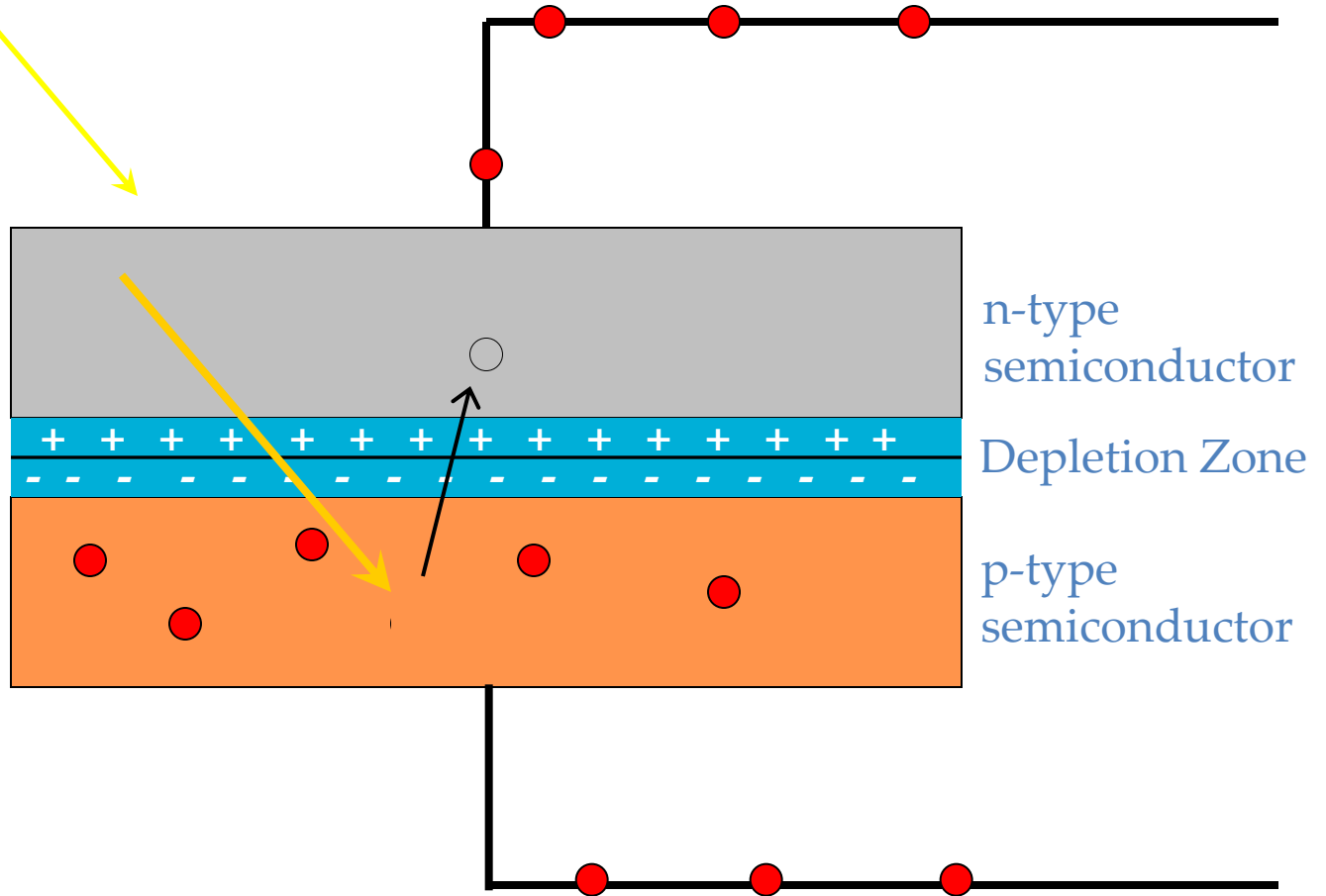


# PHOTOVOLTAIC TRANSDUCTION :

•In photovoltaic transduction the measurand is converted to voltage generated when the junction between dissimilar material is illuminated as shown in fig.

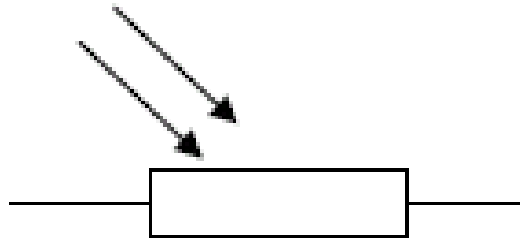


# Physics of Photovoltaic Generation



## PHOTO CONDUCTIVE TRANSDUCTION :

- In photoconductive transduction the measurand is converted to change in resistance of semiconductor material by the change in light incident on the material.



## **TRANSDUCER:**

- Transducers convert non electrical quantity to electrical quantity.

## **INVERSE TRANSDUCER:**

- Inverse transducers convert electrical quantity to a non electrical quantity

**Thank You**