

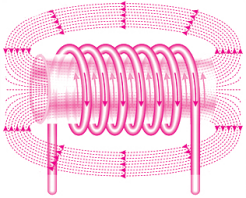
# 9. ELECTRO MAGNETIC INDUCTION

## IMP DEFINITIONS & FORMULAS

- Electro magnetic induction** is the process of generating electric current using magnetic field.
- Magnetic flux** is the total magnetic field passing through a given area.
- Magnetic flux:**  $\phi_B = \vec{B} \cdot \vec{A} = BA \cos \theta$   
**SI units:** T m<sup>2</sup>.
- Faraday's law** of induction  $\varepsilon = -N \frac{d\phi_B}{dt}$
- Lenz's law** states that induced emf always opposes the change of flux through the coil.
- Eddy currents:** The induced currents in large metal pieces due to changes in the flux are called eddy currents.
- Self inductance** (L) is the induced emf in a coil due to change of current in it .  
• **Formula:**  $L = \varepsilon / \left( -\frac{dI}{dt} \right)$   
• **SI units:** henry (H).
- Self inductance of a coil:**  $L = \mu_0 n^2 A l$
- Mutual inductance (M):** When 2 coils are placed near each other and if current in one coil changes then an emf is induced in the other coil due to mutual induction.  
• **Formula:**  $\varepsilon = -M \frac{di}{dt}$
- Mutual inductance of two long coaxial solenoids :**  $M = \mu_0 n_1 n_2 \pi r_1^2 l$

### BULLET MASTER'S

## PHYSI BEATS!



### 9) ELECTRO MAGNETIC INDUCTION(EMI) [ 1 SAQ]

#### Two Eminent Scientists : Mr. Faraday & Mr. Lenz

ఎదుటి వారు నవ్వుతుంటే మీరు నవ్వుతారు !  
ఎదుటి వారు కోప్పడితే మీకు కోపం వస్తుంది!!  
ఎదుటి వారు బాధపడితే మీరు బాధపడతారు !!!

ఎదుటి వారు నుండి Emotions మీకు Induce అప్పుడం అంటే ఇదే!

• **EMI: E** for Eddy currents, **M** for Magnetic flux, **I** for Induction

• When a magnet is moved inside a coil an emf is induced in the coil.

• Generation of induced emf in the coil by the movement of magnet inside the coil is called 'EMI'.

• **Induction is the ability to store energy** in the form of **magnetic field** whereas **capacitance is the ability to store energy** in the **electric field**.

• **Inductance** is the property of electric coil by which a voltage is induced in it by **changing magnetic field**.

• **Self inductance** is the phenomena in which a change in electric current in the coil produces an **emf in the coil** itself.

• **Self inductance** is the property of the current carrying coil that reduce the **change of current** in flowing through it.

#### IPE View

☞ **IMP VSAQ :** Lenz's Law, Eddy currents, Self inductance

**IMP SAQ :** Uses of Eddy currents, Expression for mutual inductance