[Electromagnetic Induction]

[PHYSICS BY RAJAT SACHDEV] [9580951094]

(1.) State the laws of electromagnetic induction.

(2) The magnetic flux through a coil perpendicular to the plane is varying according to the relation

$$\phi = (5t^3 + 4t^2 + 2t - 5)\ Wb$$

Calculate the induced current through the coil at $t = 2s$, if the resistance of the coil is 5Ω.

(3) A metallic rod of 1m length is rotated with a frequency of 50 rev/s with one end hinged at the centre and the other end at the circumference of a circular metallic ring of radius 1m, about an axis passing through the centre and perpendicular to the plane of the ring. A constant and uniform magnetic field of 1T and parallel to the axis is present everywhere. What is the emf between the centre and the metallic ring?

[9580951094] [Ans - 157V]

(4) A circular coil of area 300 cm^2 and 25 turns rotate about its vertical diameter with an angular speed of 40 s^{-1} in a uniform horizontal magnetic field of magnitude 0.05T. Obtain the maximum voltage induced in the coil.

[Ans - 1.5V]

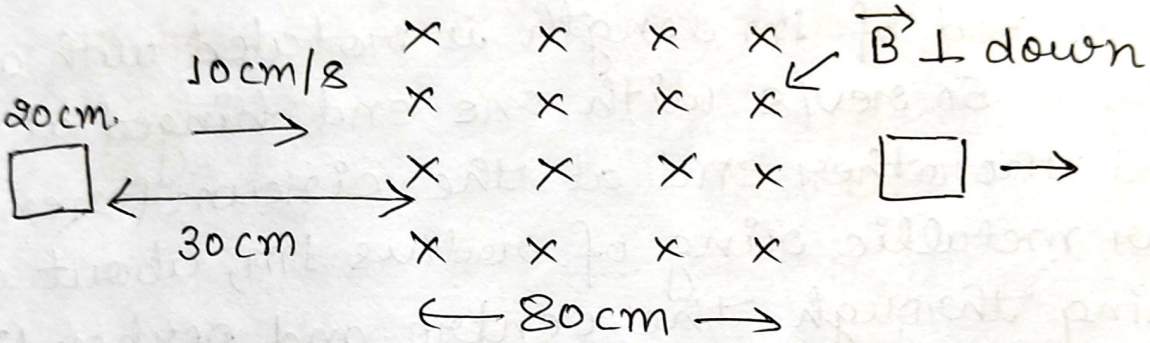
(5) Define - Self Induction & Mutual Induction.

(6) A solenoid of length 50 cm with 20 turns per cm and area of cross section 40 cm^2 completely surrounds another co-axial solenoid of the same length, area of cross-section 25 cm^2 with 25 turns per cm. Calculate the mutual-inductance of the system.

[Ans - 7.85 mH]

(7) An iron bar falling through the hollow region of a thick cylindrical shell made of copper experiences a retarding force. What can you conclude about the nature of the iron bar.

(8) A square loop of side 20 cm is initially kept 30 cm away from a region of uniform magnetic field of 0.1 T as shown in figure. It is then moved



towards the right with a velocity of 10 cm/s till it ~~gives~~ goes out of the field. Plot a graph showing the variation of

(i) magnetic flux (ϕ) through the loop with time (t)

(ii) induced emf ($\mathcal{E}$) in the loop with time t.

(iii) induced current in the loop if it has resistance of 0.1 sec.