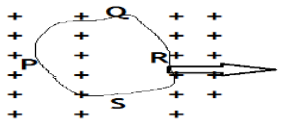
CHAPTER - 6

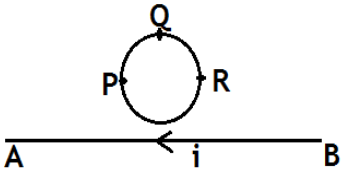
ELECTROMAGNETIC INDUCTION

One mark questions

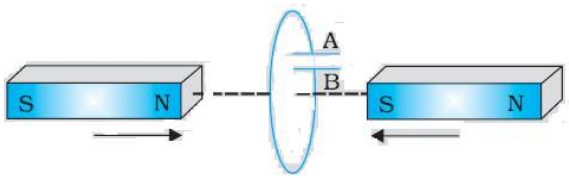
1. What is electromagnetic induction? (K)
2. Define magnetic flux through a surface. (U)
3. State Faraday's law of electromagnetic induction. (K)
4. Determine the direction of induced current in the loop given below if the loop moves out of the region of magnetic field. (A)



5. State Lenz's law of electromagnetic induction. (K)
6. What are eddy currents? (K)
7. Why eddy currents are undesirable in the metallic cores of the transformer? (U)
8. In the domestic electric power meters a rotating shiny metallic disc is seen. Why it rotates? (U)
9. How to minimize eddy currents? (U)
10. Define self-inductance of a coil. (U)
11. Write the S.I unit of self-inductance. (K)
12. Define the S.I unit of self-inductance. (U)
13. What is mutual inductance? (K)
14. Define co-efficient of mutual inductance. (U)
15. The strength of the electric current flowing in the wire from B to A is decreasing. In which direction the current is induced in the metallic loop. (A)



16. What is motional emf? (K)
17. A wire pointing north –south is dropped freely towards earth. Will any potential difference be induced across its ends? (U)
18. What happens to self-inductance of a coil if a ferromagnetic material is inserted inside the coil? (U)
19. Mention the expression for magnetic potential energy stored in an inductor when current flows through it. (K)
20. On what principle AC generator works? (K)
21. Predict the polarity of the capacitor in the situation described by the figure. (U)



Two mark questions

1. Define magnetic flux through a surface? Give its mathematical formula in vector form. (U)
2. A circular plate is placed in a uniform magnetic field such that the plane is making an angle θ with the field. For what angle of inclination the magnetic flux through the surface is (a) maximum (b) minimum? (K)
3. State and explain Faraday's law of electromagnetic induction. (U)
4. A wheel with 10 metallic spokes each 0.5 m long is rotated with a speed of 120 revolutions per minute in a plane normal to the horizontal component of earth's magnetic field 0.4×10^{-4}T. What is the induced emf between the axle and the rim of the wheel? (A)
5. State and explain Lenz's law in electromagnetic induction. (U)
6. Mention two methods of reducing eddy currents. (K)
7. Mention any two applications of eddy currents. (K)
8. The magnetic flux linked with a coil changes from 12×10^{-3} Wb (Tm^2) to 6×10^{-3}Wb in 0.01 second. Calculate the induced emf in the coil. (A)
9. Give the expression for mutual inductance induced between two co-axial solenoids and explain the terms. (K)
10. Give an expression for self-inductance of a coil and explain the terms. (K)
11. Draw a neat labeled diagram of AC generator. (S)

Three mark questions

1. Describe coil and magnet experiment of Faraday and Henry to demonstrate electromagnetic induction phenomena. (U)
2. Describe coil and coil experiment of Faraday and Henry to demonstrate electromagnetic induction. (U)
3. Describe the experiment of two stationary coils carried out by Faraday and Henry to demonstrate electromagnetic induction. (U)
4. Derive the expression for motional emf in a conducting rod moving in uniform magnetic field. (U)
5. Arrive at the expression for motional emf induced by considering Lorentz force acting on free charge carriers of a conductor. (U)
6. Mention any three applications of eddy currents. (K)
7. Derive an expression for the charge flowing through a circuit when there is a change in the magnetic flux linked with it. (U)
8. Obtain the expression for co-efficient of mutual inductance between two co-axial solenoids. (U)

9. Deduce the expression for self-inductance of a coil. (U)
10. Arrive at the expression for the emf induced in a coil due to varying current in the same coil. (U)
11. Obtain the expression for energy stored in an inductor. (U)
12. Explain the working of an AC generator with a neat labeled diagram. (S)

Five mark questions

1. Show that Lenz's law is in accordance (consistent) with the law of conservation of energy.(U)
2. What are eddy currents? Mention its applications. (K)
3. A straight conductor is moving in a uniform time independent magnetic field. Show that the mechanical energy needed to move the rod is converted into electrical energy and then to thermal energy. [or] show that the power dissipated in a rod moving in a uniform magnetic field is $P = \frac{B^2 l^2 v^2}{r}$ where r=resistance of the conductor. (U)
4. Describe the construction and working of AC generator with a labeled diagram and hence arrive at the expression for the instantaneous value of emf induced in it. (S)

NUMERICAL PROBLEMS

1. A circular coil of 100 turns, 0.2m radius has a resistance of 100Ω is held at right angles to a uniform magnetic field of 2T. it is then turned through 45^0 about an axis at right angles to the field. Calculate the charge induced in the coil. (A) **[$73.5X10^{-3}$]**
2. The electric current in a circuit varies from +2A to -2A in a time interval of 10^{-2}s.another coil of resistance 20Ω and inductance 2H is placed near it. Find the induced current in the second coil. (A) **[40A]**
3. A solenoid of radius 2.5cm, length 0.5m has 500 turns per centimeter. If a current of 1A is set up in the solenoid calculate the magnetic flux through the solenoid. (A) **[3Wb]**
4. An iron core is inserted into a solenoid of length 0.5m, area of cross-section 0.001m^2 and 400 turns per unit length. Find the permeability of the core if 5A of current produces a magnetic flux of 1.6X10^{-3}Wb through it. (A) **[636.94]**
5. A vertical copper disc of diameter 20cm makes 10 revolutions per second about a horizontal axis passing through its center. A uniform magnetic field 10^{-2}T acts perpendicular to the plane of the disc. Calculate the potential difference between its center and rim. (A) **[$3.14X10^{-3}$V]**

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