

# Magnetic Effects of Electric Current

## Basic Concepts of Magnetism and Current (Questions 1-5)

1. What is a magnetic field? How can the direction of magnetic field lines be determined? State the properties of magnetic field lines.
2. Describe Oersted's experiment. What did it demonstrate about the relationship between electricity and magnetism?
3. State the right-hand thumb rule for determining the direction of magnetic field around a current-carrying straight conductor.
4. Draw the pattern of magnetic field lines around a current-carrying straight conductor. How does the strength of magnetic field vary with distance from the conductor?
5. What is a solenoid? Draw the magnetic field pattern around a current-carrying solenoid. How is it similar to a bar magnet?

## Magnetic Field Due to Current (Questions 6-10)

6. State and explain the right-hand rule for finding the direction of magnetic field in a current-carrying circular loop.
7. How can you increase the strength of magnetic field produced by a current-carrying solenoid? List four methods.
8. What are the factors on which the strength of magnetic field at the center of a current-carrying circular coil depends?
9. Explain why the magnetic field inside a solenoid is uniform. What happens to the magnetic field when an iron core is inserted in the solenoid?
10. Two circular coils A and B are placed such that coil A lies in the plane of coil B. If current flows in both coils in the same direction, what will be the effect on each coil?

## Force on Current-Carrying Conductor (Questions 11-15)

11. When does a current-carrying conductor experience maximum force in a magnetic field? State Fleming's left-hand rule.
12. A current-carrying conductor of length 10 cm carrying 2A current is placed perpendicular to a magnetic field of 0.5 T. Calculate the force experienced by the conductor.
13. What is the principle of an electric motor? Draw a labeled diagram of a simple electric motor and explain its working.

14. Why does a current-carrying conductor experience force when placed in a magnetic field? What happens when the conductor is parallel to the magnetic field?
15. List three ways to increase the speed of rotation of an electric motor. Why is a split-ring commutator used in a DC motor?

### **Electromagnetic Induction (Questions 16-20)**

16. What is electromagnetic induction? State Faraday's law of electromagnetic induction.
17. State Fleming's right-hand rule. How does it differ from Fleming's left-hand rule?
18. Explain the principle and working of an electric generator (AC generator) with a labeled diagram.
19. What is the difference between AC and DC generators? Why does an AC generator produce alternating current?
20. State Lenz's law. How does it follow the principle of conservation of energy?

### **Additional Application-Based Questions:**

#### **Practical Applications:**

- Explain why the coil of an electric motor is wound on an iron core. What is the function of brushes in an electric motor?
- How does a galvanometer work? What modifications are made to convert it into an ammeter and voltmeter?
- Why are the pole pieces of a loudspeaker made curved? How does a loudspeaker convert electrical energy to sound energy?
- Explain the working of an electric bell using the principle of electromagnetism.

#### **Comparative Questions:**

- Compare the construction and working of AC and DC motors. Which type is more commonly used and why?
- How does a motor differ from a generator? Can the same device work as both motor and generator?
- Compare electromagnets with permanent magnets. What are the advantages of electromagnets?
- What are the similarities and differences between Fleming's left-hand rule and right-hand rule?

#### **Numerical Problems:**

- A conductor of length 0.5 m carrying 10 A current is placed at right angles to a uniform magnetic field of 2 T. Calculate the force on the conductor.
- If the above conductor makes an angle of  $30^\circ$  with the magnetic field, what will be the force?
- An electric motor takes 2 A current from a 12 V battery. If the motor is 80% efficient, calculate the mechanical power output.

#### **Conceptual Questions:**

- Why does the speed of a DC motor decrease when load is applied? How can this be prevented?
- Explain why transformers work only with AC and not with DC current.
- What would happen if the split-ring commutator in a DC motor is replaced by slip rings?
- Why is soft iron used as the core of electromagnets and not steel?

#### **Real-life Applications:**

- How do maglev trains work? What is the principle behind magnetic levitation?
- Explain the working of a microphone. How does it convert sound energy to electrical energy?
- Why do electric motors get heated during operation? How can overheating be prevented?
- How does an MRI machine use strong magnetic fields for medical imaging?

#### **Advanced Understanding:**

- Explain why the direction of induced current always opposes the change causing it.
- What is mutual induction? Give examples of devices that work on this principle.
- How does eddy current affect the efficiency of electrical machines? How are eddy current losses minimized?
- Explain the principle behind induction cooking and how it differs from conventional heating methods.