CLASS XII – PHYSICS (042)
PRACTICE PAPER – CHAPTER 6: ELECTROMAGNETIC INDUCTION

Academic Session 2026–27

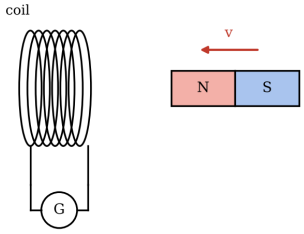
Maximum Marks : 35 **Time Allowed : 1 hour 15 minutes**

General Instructions

(1) There are 18 questions in all. All questions are compulsory.
(2) The question paper has five sections: Section A, B, C, D and E.
(3) Section A (Q.1–9) has seven MCQs and two Assertion–Reasoning questions of 1 mark each. Section B (Q.10–13) has four questions of 2 marks each. Section C (Q.14–16) has three questions of 3 marks each. Section D (Q.17) is one case study based question of 4 marks. Section E (Q.18) is one long answer question of 5 marks.
(4) There is no overall choice. An internal choice is provided in Q.12 (Section B), Q.15 (Section C), Q.17 part (iv) (Section D) and Q.18 (Section E). Attempt only one of the choices in such questions.
(5) Use of calculators is not allowed.
(6) You may use the following values of physical constants wherever necessary: $\mu_0 = 4\pi \times 10^{-7}$ T m A^{-1}, $\pi = 3.14$.

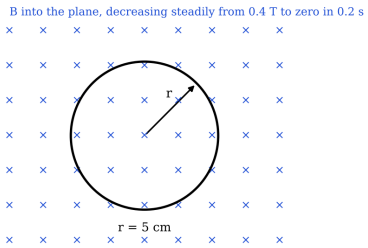
SECTION A (9 × 1 = 9)

1. The north pole of a bar magnet is moved towards a coil connected to a galvanometer, as shown. As seen from the side of the magnet, the induced current in the coil is _____ and the coil _____ the magnet. **1**



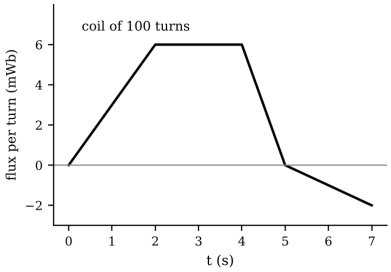
(a) clockwise; attracts
(b) clockwise; repels
(c) anticlockwise; repels
(d) anticlockwise; attracts

2. A circular loop of radius 5 cm lies in a region of a uniform magnetic field directed into the plane of the paper, as shown. The field decreases steadily from 0.4 T to zero in 0.2 s. The emf induced in the loop and the sense of the induced current are **1**



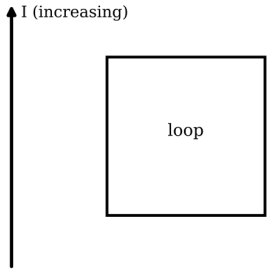
(a) 15.7 mV, clockwise
(b) 15.7 mV, anticlockwise
(c) 7.85 mV, clockwise
(d) 31.4 mV, clockwise

3. The magnetic flux linked with each turn of a coil of 100 turns varies with time as shown. The interval during which the induced emf is zero and the magnitude of the maximum induced emf are **1**



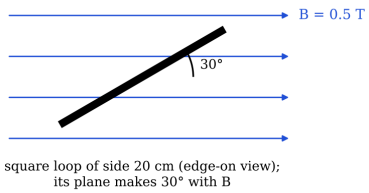
(a) 2 s to 4 s; 0.06 V
(b) 2 s to 4 s; 0.6 V
(c) 4 s to 5 s; 0.6 V
(d) 0 to 2 s; 0.3 V

4. A rectangular loop lies in the plane of the paper next to a long straight wire carrying a current I upwards, as shown. If I is increasing with time, the induced current in the loop is _____ and the loop is _____ the wire. **1**



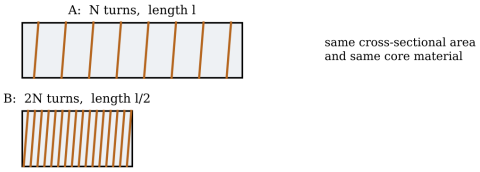
(a) clockwise; attracted towards
(b) clockwise; repelled from
(c) anticlockwise; attracted towards
(d) anticlockwise; repelled from

5. A square loop of side 20 cm is placed in a uniform magnetic field of 0.5 T with its plane making an angle of 30° with the field, as shown. The magnetic flux through the loop is **1**



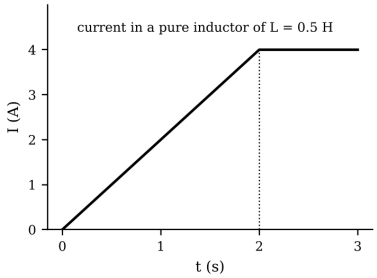
(a) 1.0×10^{-2} Wb
(b) 1.7×10^{-2} Wb
(c) 2.0×10^{-2} Wb
(d) 0.5×10^{-2} Wb

6. Two solenoids A and B have the same cross-sectional area and the same core material. A has N turns and length l; B has 2N turns and length l/2, as shown. The ratio of the self-inductance of B to that of A is **1**



(a) 2
(b) 8
(c) 4
(d) 16

7. The current in a pure inductor of 0.5 H varies with time as shown. At t = 2 s the emf induced in the inductor (while the current is changing) and the energy stored in it are respectively **1**



(a) 2 V, 4 J
(b) 0.5 V, 8 J
(c) 1 V, 2 J
(d) 1 V, 4 J

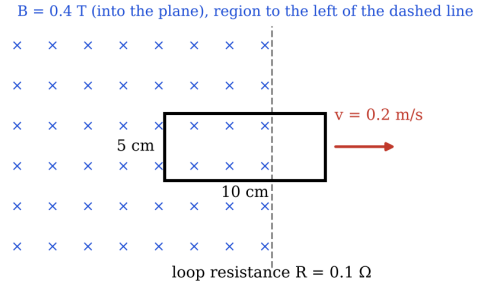
For Questions 8 and 9, a statement of Assertion (A) is followed by a statement of Reason (R). Select the correct answer from the options below.
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

8. **Assertion (A):** A conductor of length l moving with speed v parallel to a uniform magnetic field has a motional emf Blv across its ends. **1**
Reason (R): The Lorentz force q(**v** × **B**) on the free charges of the conductor is zero when **v** is parallel to **B**.

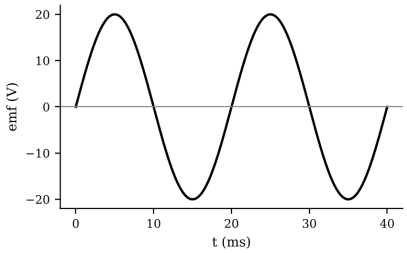
9. **Assertion (A):** Lenz's law is in accordance with the law of conservation of energy. **1**
Reason (R): If the induced current helped the change in flux, a magnet pushed gently towards a coil would keep accelerating without any energy being spent.

SECTION B (4 × 2 = 8)

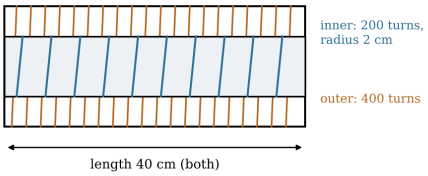
10. A rectangular loop of resistance 0.1 Ω is being pulled out of a region of uniform magnetic field with a constant velocity, as shown. Find the emf induced in the loop and the current in it. State the direction of the current (clockwise or anticlockwise). **2**



11. The graph shows the emf produced by a coil rotating in a uniform magnetic field. Find (a) the frequency of rotation and the peak emf, (b) the emf at the instant t = 1/600 s. **2**



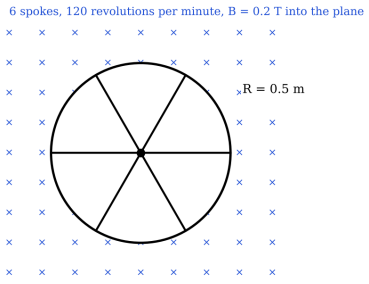
12. **(A)** Two long co-axial solenoids of the same length 40 cm are shown. Find the mutual inductance of the pair. Hence find the emf induced in the outer solenoid when the current in the inner solenoid changes at the rate of 5 A s^{-1}. **2**



OR

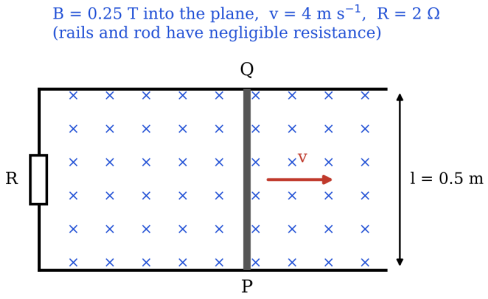
(B) The current in a coil of self-inductance 0.4 H falls uniformly from 5 A to zero in 0.1 s. Find the average emf induced in the coil and the energy initially stored in it.

13. A wheel with 6 metallic spokes, each 0.5 m long, rotates at 120 revolutions per minute in a plane perpendicular to a uniform magnetic field of 0.2 T, as shown. Find the emf induced between the axle and the rim. Does the emf change if the number of spokes is increased? Give a reason. **2**



SECTION C (3 × 3 = 9)

14. A conducting rod PQ of length 0.5 m moves with a constant speed of 4 m s^{-1} on smooth rails in a uniform magnetic field of 0.25 T, as shown. The resistance of the circuit is only the resistor R = 2 Ω. (a) Find the emf induced in the rod. (b) Find the current and its direction through the rod. (c) Find the force required to keep the rod moving at constant speed and the power supplied by this force. **3**

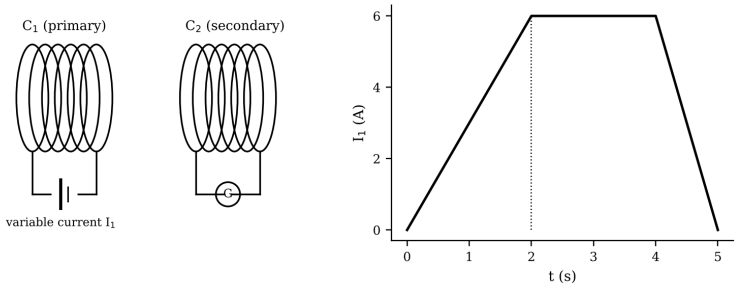


15. **(A)** Derive an expression for the emf induced in a straight conductor of length l moving with velocity v perpendicular to a uniform magnetic field B, using Faraday's law with a rectangular circuit PQRS in which the rod PQ is free to move. **3**

OR

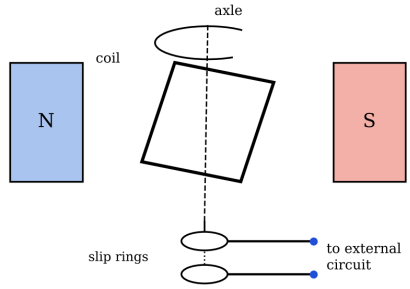
(B) State Lenz's law. A north pole of a bar magnet is moved towards a closed coil. Using Lenz's law, find the direction of the induced current and show that Lenz's law is consistent with the law of conservation of energy.

16. A primary coil C_1 carries a current I_1 which varies with time as shown in the graph. A secondary coil C_2 placed near it has an induced emf of magnitude 0.9 V between t = 0 and t = 2 s. (a) Find the mutual inductance of the pair of coils. (b) Find the induced emf in C_2 between t = 4 s and t = 5 s and compare its polarity with that between 0 and 2 s. (c) What is the induced emf between 2 s and 4 s? Explain. **3**



SECTION D (1 × 4 = 4)

17. **Case Study.** An ac generator converts mechanical energy into electrical energy. A rectangular coil of N turns and area A is rotated with a constant angular speed ω in a uniform magnetic field B about an axis perpendicular to the field, using slip rings and carbon brushes to connect it to the external circuit. If the plane of the coil is perpendicular to the field at t = 0, the flux is $\Phi = BA\cos\omega t$ and the emf is $\varepsilon = NBA\omega \sin\omega t$. The generator shown has N = 100, A = 100 cm^2, B = 0.1 T and rotates at 50 Hz (take π = 3.14). Answer the following: **4**



coil: N = 100 turns, area 100 cm^2; B = 0.1 T; frequency of rotation 50 Hz

(i) The emf induced in the coil is maximum when the plane of the coil is
(a) perpendicular to the field (b) parallel to the field (c) at 45° to the field (d) at 30° to the field

(ii) The peak emf of the generator is
(a) 3.14 V (b) 31.4 V (c) 314 V (d) 0.314 V

(iii) If the speed of rotation is doubled, the peak emf and the frequency become respectively
(a) 31.4 V, 100 Hz (b) 62.8 V, 50 Hz (c) 62.8 V, 100 Hz (d) 15.7 V, 100 Hz

(iv) The emf at t = 1/300 s after the instant when the plane of the coil is perpendicular to the field is about
(a) 15.7 V (b) 27.2 V (c) 31.4 V (d) zero

OR

(iv) If the frequency of rotation is halved and the number of turns is doubled, the peak emf becomes
(a) 15.7 V (b) 31.4 V (c) 62.8 V (d) 7.85 V

SECTION E (1 × 5 = 5)

18. **(A)** What is self-induction? Obtain an expression for the energy stored in an inductor of self-inductance L when a current I is established in it. (3)
A long solenoid of 1000 turns, length 0.5 m and cross-sectional area 4 cm^2 carries a current of 2 A. Find its self-inductance and the energy stored in it (take π = 3.14). (2) **5**

OR

(B) Describe the principle and working of an ac generator, with a labelled diagram, and derive the expression for the instantaneous emf produced in its rotating coil. (3)
A coil of 50 turns and area 0.04 m^2 rotates at 50 Hz in a uniform magnetic field of 0.5 T about an axis perpendicular to the field. Find the peak emf and the emf at the instant when the normal to the coil makes 60° with the field (take π = 3.14). (2)

— End of Question Paper —