CLASS XII

TOPIC/CHAPTER

.Electromagnetic induction and Alternating current

Section A Conceptual and application type questions

1	What is the power dissipated in an AC circuit in which voltage and current are given by V = $230\sin(\omega t+\pi/2)$ and I = $10\sin\omega t$? Give reason	1 2005
2	Two identical loops ,one of copper and other of constantan ,are removed from a magnetic field within the same time interval. In which loop will the induced current be greater? Justify.	1
3	A conducting coil is moved relative to a magnetic field .Will there be induced emf and induced current always? Justify	1
4	What is the significance of power factor in i) electrical appliances ii) transmission of electric power?	1
5	Two identical bar magnets are dropped from the same height simultaneously , one falls through a copper tube and the other falls through air, will they reach ground at the same time? Justify.	1
6	The south pole of a magnet is brought near a conducting loop. What is the direction of induced current as observed by a person on the other side of the loop?	1
7	A radio frequency choke is air cored coil where as an audio frequency choke is iron cored. Give reason.	1
8	How does the selfinductanceof an air core coil change, when i) the number of turns in the coil is decreased? ii) an iron rod is introduced in the coil?	2
9	A bismuth rod is introduced in a solenoid carrying current ,how do i) its self inductance ii) emf induced in the solenoid change?	2
10	A copper coil L wound on a soft iron core and a lamp B is connected to a battery E through a tap key K. when the key is closed, the lamp glows dimly .But when the key is suddenly opened , the lamp flashes for an instant to much greater brightness . Explain.	2
11	In any ac circuit ,is the applied instantaneous voltage equal to the algebraic sum of the instantaneous voltages across the series elements of the circuit ?	1

12 A conducting loop of area A and resistance R is placed perpendicular to the magnetic field B. The loop is withdrawn completely from the field. Derive an expression for induced charge that flows through any cross section of the wire 2

13 The south pole of a magnet is brought near a conducting loop. What is the direction of induced current as observed by a person on the other side of the loop? 1

14 A bulb B and an inductor L are connected in series to the AC mains. The bulb glows with some brightness. How will the glow of the bulb change when a i) a soft iron core ii) bismuth core is introduced inside the inductor? Give reasons. 2

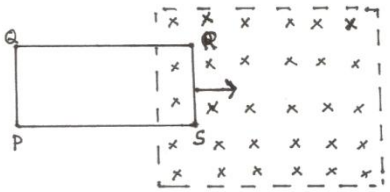
15 A coil of number of turns N, area A, is rotated at a constant angular speed w, in a uniform magneticfield B, and connected to a resistor R. Deduce expressions for : 2 (2008)

(i) Maximum emf induced in the coil

(ii) Power dissipation in the coil.

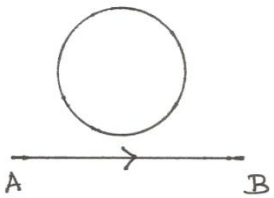
16 A bulb B and a capacitor C are connected in series to the AC mains. The bulb glows with some brightness. How will the glow of the bulb change when a dielectric slab is introduced between the plates of the capacitor? Give reasons. 1

17 1



Mark the direction of induced current in the coil PQRS. State the rule used to find the direction of induced current. What would be the direction of induced current if the direction of magnetic field is reversed?

18 2



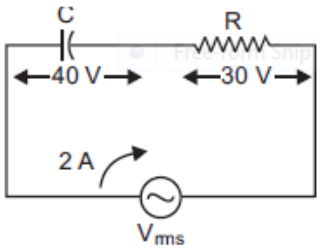
The figure shows a circular coil and a conductor AB carrying current from A to B. If the current is i) decreasing ii) increasing find the direction of induced current in the circular coil.

19 Draw a labelled circuit arrangement showing the windings of primary and secondary coil in atransformer. Explain the underlying principle and working of a step-up transformer. Write anytwo major sources of energy loss in this device. 2008

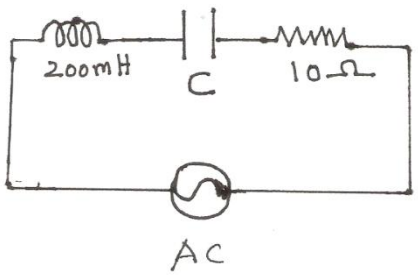
20	A step-up transformer converts a low voltage into high voltage. Does it not violate theprinciple of conservation of energy? Explain.	2009	2
21	Define the quality factor in an a.c. circuit. Why should the quality factor have high valuein receiving circuits? Name the factors on which it depends.	2009	3
22	Derive an expression for the average power consumed in a series LCR circuit connected toa.c. source in which the phase difference between the voltage and the current in the circuitis Φ.	2009	2

Section B Numerical problems

1	Calculate the (i) impedance, (ii) wattless current of the given a.c. circuit.	2008	2



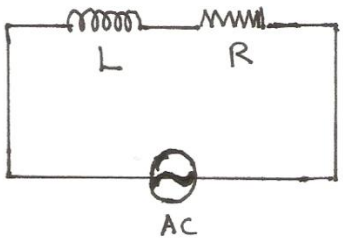
2	A jet plane is travelling west at 450 ms^{-1}. If the horizontal component of earth's magnetic field atthat place is 4 X 10^{-4} tesla and the angle of dip is 30°, find the emf induced between the ends ofwings having a span of 30 m.	2008	2
3	How much current is drawn by the primary coil of a transformer which steps down 220 V to 22 Vto operate device with an impedance of 220 ohm ?	2008	2
4	In the circuit given, calculate i) the capacitance C of the capacitor , if the power factor of the circuit is unity and ii) also calculate the Q –factor of the circuit .Take ν =50Hz		2



5	In a series R-C circuit, R =30Ω ,C= 0.25μF, V= 100V and ω = 10000 rad/s. Find the current in the circuit and calculate the potential drop across the resistor and the capacitor. Is the algebraic sum of voltages more than the source voltage? If yes ,resolve the paradox.		2
6	In a given circuit, the potential drop across the inductor L and resistor R are 200V and 150V respectively and the rms value of current is 5A .Calculate the i) impedance of the circuit ii) the phase angle between the current and voltage.		2

7 A bulb of resistance 10Ω connected to an inductor of inductance L in series with an AC voltage source marked 100V,50Hz. If the phase angle between voltage and current is π/4radian, calculate the value of L 2

8 When an inductor L and a resistor R in series are connected across 12V,50Hz supply, a current of 0.5Aflows in the circuit, the current differs in phase from applied voltage by π/3 radian. Calculate L and R 3



9 A train is running due north onmetregauge at a speed of 36km/h. What will be the emf generated between the rails, if the vertical component of the earth's magnetic field at that place is 4×10^{-5} T? 3

10 A coil having an area of cross section 0.05 m^2 and number of turns 100 is placed at right angles to a magnetic field of strength 0.08 T. How muchemf will be induced in it , if the field is reduced to 0.04 T in 0.01s? 3

11 Magnetic flux in closed circuit varies with time t according to the equation $\varphi = (6t^2+5t+ 1)$Wb. If the resistance of the circuit is 10Ω , what is the magnitude of induced current at t= 5s ? 2

12 In an ideal transformer , the number of turns in the primary and secondary are 200 , 1000 respectively. If the input at primary is 10kW-200V , calculate the i) output voltage ii) current in the primary coil. 2

13 A 200mH inductor is connected in series to a resistor of 10Ω. An AC supply of 220V, 50Hz is connected across it. Calculate i) the rms value of current ii) the peak value of current iii) the power factor of the circuit and write the equation for instantaneous value of current. 3

14 In the previous question calculate time lag between effective value of emf and current. 2

15 A coil of inductance 0.5H is connected to a 18V battery .Calculate the rate of growth of current in it when the key is just closed? 1