



CHAPTER TEST

STD: XII

PHYSICS – EMI, AC and EM Waves

TIME: 1 HR 15 MIN

MARKS: 35

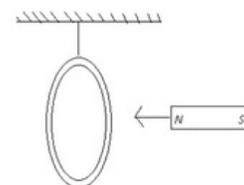
Answer all the questions. Section *A* carries 1 mark, Section *B* carries 2 marks, Section *C* carries 3 marks, Section *D* carries 5 marks, Section *E* carries 4 marks.

SECTION- A

- In electromagnetic induction the induced charge does not depend upon:
 - Change in flux
 - time
 - resistance of coil
 - None of these
- The peak voltage in an AC circuit is 707 V. The virtual voltage is.
 707. V
 - 1000 V
 - 100 V
 - 200 V
- The dimensional formula for impedance is
 - $[ML^2T^{-2}A^{-2}]$
 - $[ML^2T^{-3}A^{-2}]$
 - $[ML^2T^{-2}A^{-1}]$
 - $[ML^2T^{-2}A^{-3}]$
- The dimensions of $1/\mu_0\epsilon_0$ are:
 - $[LT^{-1}]$
 - $[L^{-1}T]$
 - $[L^{-2}T^2]$
 - $[L^2T^{-2}]$
- Assertion (A): When the magnetic flux changes around a metallic conductor, the eddy current is produced
Reason (R): Electric potential determines the flow of charge.
 - Both *A* and *R* are true and *R* is the correct explanation of *A*.
 - Both *A* and *R* are true and *R* is not the correct explanation of *A*
 - A* is true but *R* is false.
 - A* is false and *R* is true.
- Assertion (A): The ozone layer present at the top of stratosphere is very crucial for human survival.
Reason (R): Ozone layer prevents IR radiation.
 - Both *A* and *R* are true and *R* is the correct explanation of *A*.
 - Both *A* and *R* are true and *R* is not the correct explanation of *A*
 - A* is true but *R* is false.
 - A* is false and *R* is true.

SECTION – B

- A copper ring is suspended by a thread. One end of a magnet is brought horizontally towards the ring. How will it affect the position of the ring?





8. Define the mutual inductance of two coils and write its SI unit. Name two factors on which the mutual inductance between a pair of coil depends?
9. What is the power factor of an LCR circuit at resonance?
10. How are the electric vector \vec{E} , the magnetic vector \vec{B} and velocity vector \vec{v} taken along direction.

SECTION – C

11. Show mathematically that in a pure AC circuit, the circuit leads behind the voltage by $\pi/2$.
12. What do you understand by 'wattless current'? why the current passing in a choke coil wattless?
13. Support that electric field of an electromagnetic wave in vacuum is

$$\vec{E} = [(3.1N/C)] \cos \{1.8 \text{ rad/m}\}y + (5.4 \times 10^6 \text{ rad/s})t \hat{i}$$

- (a) What is the direction of propagation?
 - (b) What is wavelength?
 - (c) What is frequency?
 - (d) What is amplitude of the magnetic field part of the wave?
 - (e) Write an expression for the magnetic field part of the wave?
14. A sinusoidal voltage $V=200\sin 314t$ is applied to a 10Ω resistor. Find
 - (i) rms voltage
 - (ii) rms current
 - (iii) power dissipated as heat

SECTION – D

15. In alternating current circuit an inductance L , a capacitance C and a resistance R are connected in series. Derive the expression for the impedance and the phase angle. What is the impedance at resonance?

SECTION – E

16. Case Study Based Question:

A local electric tram service uses overhead cables and rails to supply electric power to tram cars moving through the city. During regular maintenance, an engineer observes a tram moving at a constant speed of 14m/s along a straight horizontal track beneath transmission wires that run east–west. The separation between the rails is 1.2m . The Earth's magnetic field at the location has a magnitude of $40\mu\text{T}$ and the angle between the field and the vertical is 60° , pointing downwards and towards the north. The engineer notes sparks at the contact point between the tram and rails, prompting an investigation into induced emf and safety measures needed for the crew and passengers.

Based on the above scenario, answer the following:

- i) State the law used to calculate the emf induced in a straight conductor moving in a uniform magnetic field.
- ii) Write the mathematical expression for the induced emf and identify each quantity.
- iii) Calculate the magnitude of emf induced between the two rails as the tram moves.

(Assume the magnetic field component perpendicular to the plane of the rails.)



iv) Explain what would happen to the induced emf if:

- a) The tram speed increased,
- b) The orientation of the track was changed to run north–south while all other settings remain unchanged.