

12

Time : 3.00 hrs.

Quarterly Examination - 2024  
PHYSICS

Reg. No.

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Max. Marks : 70

## PART - I

15 x 1 = 15

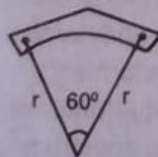
Note : (i) Answer all the questions.

(ii) Choose the most appropriate answer from the given four alternatives and write the option code and the corresponding answer.

- The speed of light in an isotropic medium depends on  
a) the nature of propagation b) its intensity c) the motion of the source w.r.t medium d) its wavelength
- A ray of light travelling in a transparent medium of refractive index  $n$  falls on a surface separating the medium from air at an angle of incidence of  $45^\circ$ . The ray can undergo total internal reflection for the following  $n$ ..... a)  $n = 1.25$  b)  $n = 1.33$  c)  $n = 1.4$  d)  $n = 1.5$
- Two identical conducting balls having positive charges  $q_1$  and  $q_2$  are separated by a centre to centre distance  $r$ . If they are made to touch each other and then separated to the same distance, the force between them will be a) less than before b) same as before c) more than before d) zero
- A short electric dipole has a dipole moment of  $16 \times 10^{-9}$  cm. The electric potential due to the dipole at a point at a distance of 0.6 m from the centre of the dipole situated on a line making an angle of  $60^\circ$  with the

dipole axis is.....  $\left( \frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ Nm}^2/\text{C}^2 \right)$  a) 50V b) 200V c) 400V d) zero

- Which of the following physical quantity has Vm as its unit  
a) Electric flux b) magnetic flux c) electric field d) magnetic field
- The average energy density of an electromagnetic wave is  
a)  $\frac{1}{2} \epsilon_0 E$  b)  $\frac{1}{2} \epsilon_0 E^2$  c)  $\frac{1}{4} \epsilon_0 E^2$  d)  $\frac{1}{4} \epsilon_0 E$
- The instantaneous magnitude of the electric and magnetic field vectors in electromagnetic wave are related by  $C =$  a)  $\frac{E}{B}$  b)  $\frac{B}{E}$  c)  $BE$  d)  $\sqrt{\frac{E}{B}}$
- A toaster operating at 240 V has a resistance of  $120 \Omega$ . Its power is  
a) 400W b) 2W c) 480W d) 240W
- A carbon resistor of  $(47 \pm 4.7) \text{ K}\Omega$  to be marked with rings of different colours for its identification. The colour code sequence will be a) yellow - green - violet - gold b) yellow - violet - orange - silver c) violet - yellow - orange - silver d) green - orange - violet - gold
- A bar magnet of length 'l' and magnetic moment 'Pm' is bent in the form of an arc as shown in figure. The new magnetic dipole moment will be



- a)  $\frac{2}{\pi} Pm$  b)  $Pm$  c)  $\frac{1}{2} Pm$  d)  $\frac{3}{\pi} Pm$

- A circular coil of radius 5 cm and 50 turns carries a current of 3 ampere. The magnetic dipole moment of the coil is nearly a)  $1.0 \text{ Am}^2$  b)  $1.2 \text{ Am}^2$  c)  $0.5 \text{ Am}^2$  d)  $0.8 \text{ Am}^2$

- The ratio of magnetic length and geometrical length is a)  $\frac{6}{5}$  b)  $\frac{5}{7}$  c)  $\frac{7}{5}$  d)  $\frac{5}{6}$

13. In a series RL circuit, the resistance and inductive reactance are the same. Then the phase difference between voltage and current in the circuit is a)  $\frac{\pi}{6}$  b)  $\frac{\pi}{4}$  c) zero d)  $\frac{\pi}{2}$
14.  $\frac{20}{\pi^2}$  H inductor is connected to capacitor of capacitance C. The value of C in order to impart maximum power at 50Hz is a)  $50 \mu\text{F}$  b)  $0.5 \mu\text{F}$  c)  $500 \mu\text{F}$  d)  $5 \mu\text{F}$
15. A device which does not allow direct current to flow through it is a) capacitor b) resistor c) transformer d) inductor

## PART - II

6 x 2 = 12

Answer any six questions. Question number 24 is compulsory.

16. Define Electrostatic potential.
17. Distinguish between drift velocity and mobility.
18. State Joule's law of heating.
19. What is magnetic susceptibility?
20. Give the limitations of cyclotron.
21. State Fleming's right hand rule.
22. The equation for an alternating current is given by  $i = 77 \sin 314t$ . Find frequency and time period.
23. What is displacement current?
24. The angle of minimum deviation for an equilateral prism is  $37^\circ$ . Find the refractive index of the material of the prism.

## PART - III

6 x 3 = 18

Answer any six questions. Question Number 27 is compulsory.

25. Derive an expression for the torque experienced by a dipole due to a uniform electric field.
26. A parallel plate capacitor has square plates of side 5cm and separated by a distance of 1mm. Calculate the capacitance of this capacitor.
27. A cell supplies a current of 0.9A through a  $2\Omega$  resistor and a current of 0.3A through a  $7\Omega$  resistor. Calculate the internal resistance of the cell.
28. Give an account of magnetic Lorentz force.
29. Give the properties of dia/para/ferro magnetic materials.
30. How will you induce an emf by changing the area of the coil?
31. Find out the phase relationship between voltage and current in a pure resistor circuit.
32. What is total internal reflection. Give the condition for the total internal reflection takes place.
33. What is the focal length of the combination if the lenses of focal lengths  $-70\text{cm}$  and  $150\text{cm}$  are in contact? What is the power of the combination?

## PART - IV

Answer all the questions.

5 x 5 = 25

34. a) Derive an expression for electrostatic potential due to an electric dipole. (OR)  
b) Derive the expression for the force between two parallel, current carrying conductors.
35. a) Explain the equivalent resistance of a series and parallel resistor network. (OR)  
b) Explain the construction and working of transformer.
36. a) Obtain the magnetic field at a point on the equatorial line of a bar magnet. (OR)  
b) Explain the types of emission and absorption spectrum.
37. a) Obtain lens maker's formula. (OR)  
b) Derive an expression for phase angle between the applied voltage and current in a series RLC circuit.
38. a) Obtain the expression for electric field due to an infinitely long charged wire. (OR)  
b) Describe the Fizeau's method to determine the speed of light.