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Reg. No. 1 2 2 5 A1 0 3

Time : 3.00 hrs.

Quarterly Examination - 2024

Max. Marks : 70

PHYSICS

PART - I

Note : Answer all the questions. Choose the correct answer 15 x 1 = 15

1. Two identical conducting balls having positive charges q_1 and q_2 are seperated by a centre to centre distance r. If they are made to touch each other and then seperated to the same distance, the force between them will be
   a) less than before b) same as before c) more than before d) zero
2. An electric dipole is placed as an alignment angle of 30° with an electric field of 2×10^5 NC^{-1}. It experiences a torque equal to 8 Nm. The charge on the dipole if the dipole length is 1cm is
   a) 4 mC b) 8 mC c) 5 mC d) 7 mC
3. A parallel plate capacitor stores a charge Q at a voltage V. Suppose the area of the parallel plate capacitor and the distance between the plates are each doubled then which is the quantity that will change
   a) capacitance b) charge c) voltage d) energy density
4. A wire of resistance 2 Ohms per meter is bent to form a circle of radius 1m. The equivalent resistance between its two diametrically opposite points, A and B as shown in the figure is

   a) $\pi\,\Omega$ b) $\frac{\pi}{2}\Omega$ c) $2\pi\Omega$ d) $\frac{\pi}{4}\,\Omega$

   

5. In a large building, there are 15 bulbs of 40W, and 5 bulbs of 100W, 5 fans of 80W and 1 heater of 1 KW are connected. The voltage of electric mains is 220V. The maximum capacity of the main fuse of the building will be a) 14A b) 8A c) 10A d) 12A
6. In Joule's heating law, when R and t are constant, if the H is taken along the y axis and I^2 along the x-axis, the graph is a) straight line b) parabola c) circle d) ellipse
7. A particle having mass m and charge q accelerated through a potential difference V. Find the force experiences when it is kept under perpendicular magnetic field $\vec{B}$

   a) $\sqrt{\frac{2q^3BV}{m}}$ b) $\sqrt{\frac{q^3B^2V}{2m}}$ c) $\sqrt{\frac{2q^3B^2V}{m}}$ d) $\sqrt{\frac{2q^3BV}{m^3}}$

8. The vertical component of Earth's magnetic field at a place is equal to the horizontal component. What is the value of angle of dip at this place?
   a) 30° b) 45° c) 60° d) 90°
9. The potential energy of magnetic dipole whose dipole moment is $\vec{P_m} = (-0.5\,\hat{i} + 0.4\,\hat{j})$ Am^2 kept in uniform magnetic field $\vec{B} = -0.2\,\hat{i}\,T$ a) –0.2 J b) –0.8 J c) 0.1 J d) 0.8 J
10. When the current changes from +2A to –2A in 0.05 s, and emf of 8V is induced in a coil. The co-efficient of self induction of the coil is
    a) 0.2 H b) 0.4 H c) 0.8 H d) 0.1 H
11. In a transformer, the number of turns in the primary and the secondary are 410 and 1230 respectively. If the current in primary is 6A, then that in the secondary coil is
    a) 2A b) 18A c) 12A d) 1A
12. An inductor of 20 mH, a capacitor 50 µF and a resistor 40Ω are connected ins eries across a source of emf v = 10 sin 340t. The power loss in AC circuit is
    a) 0.76 W b) 0.89 W c) 0.46 W d) 0.67 W

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13. Which of the following electromagnetic radiations is used for finding the formation of kidney stones
a) microwave b) gamma rays c) x - rays d) infra red

14. An e.m wave is propogating in a medium with a velocity $\vec{V} = V\hat{i}$. The instantaneous oscillating electric field of this e.m wave is along +y axis, then the direction of oscillating magnetic field of the c.m. wave will be along
a) –y direction b) –x direction c) +z direction d) –z direction

15. Which of the following is an electromagnetic wave?
a) α - rays b) β- rays c) γ- rays d) all of them

PART - II

II. Write any six short answers. Q.No.24 is compulsory 6 x 2 = 12

16. Define electrostatic potential.
17. It is safer to be inside a car rather than sitting under a tree during lightning. why?
18. State Kirchoff's first rule.
19. A sample of HCl gas is placed in a uniform electric field of magnitude 3×10^4 NC^{-1}. The dipole moment of each HCl molecule is 3.4×10^{-30} cm. Calculate the maximum torque experienced by each HCl molecule.
20. Define Remanence.
21. What are the methods of increasing the currense sensitivity of a galvanometer?
22. Differentiate step up transformer and step down transformer.
23. What are electromagnetic waves?
24. If an electric field of magnitude 570 NC^{-1}, is applied in the copper wire. Find the acceleration experienced by the electron.

PART - III

III. Answer any six questions. Q.No.33 is compulsory. 6 x 3 = 18

25. Write a short note on basic properties of charges.
26. Derive expression for resultant capacitance, when capacitors are connected in parallel.
27. How can you differentiate Peltier effect and Seebeck effect?
28. How the emf of two cells are compared using potentiometer?
29. What are the special features of magnetic borentz force?
30. Explain the concept of velocity selector.
31. Find out the phase relationship between voltage and current in a pure resistor circuit.
32. Discuss the Hertz experiment.
33. Find the impedance of a series RLC circuit if the inductive reactance, capacitive reatance and resistance are 184Ω, 144Ω and 30Ω respectively. Also calculate the phase angle between voltage and current.

PART - IV

IV. Answer all the questions. 5 x 5 = 25

34. Obtain the expression for electric field due to an infinitely long charged wire. **(OR)**
Explain in detail the effect of a dielectric placed in a parallel plate capacitor.
35. Describe the microscopic model of current and obtain microscope form of Ohm's law. **(OR)**
Obtain the condition for bridge balance in Wheatstone's bridge.
36. Discuss the working of cyclotron in detail. **(OR)**
Derive the expression for the force on a current carrying conductor in a magnetic field.
37. Show mathematically that the rotation of a coil in a magnetic field over one rotation induces an alternating emf of one cycle. **(OR)**
Prove that the total energy is conserved during LC oscillations.
38. Obtain an expression for motional emf from Lorontz force. **(OR)**
Write down Maxwell equations in integral form.