One Two Academy

Magnetism and magnetic effects of Electric current

Maximum Marks : 25 **PHYSICS** **Time: 50 Minutes**

Choose the correct answer :- **3x1=3**

1. 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 A m^2 (b) 1.2 A m^2 (c) 0.5 A m^2 (d) 0.8 A m^2

2. A non-conducting charged ring carrying a charge of q, mass m and radius r is rotated about its axis with constant angular speed ω. Find the ratio of its magnetic moment with angular momentum is

(a) $\frac{q}{m}$ (b) $\frac{2q}{m}$ (c) $\frac{q}{2m}$ (d) $\frac{q}{4m}$

3.The SI unit of magnetic flux ϕ_B is

(a)Coulomb (b)Ampere (c)Candela (d)weber

Answer the following :- **3x2=6**

4. Define magnetic flux.
5. State Biot-Savart's law.
6. A coil of a tangent galvanometer of diameter 0.24 m has 100 turns. If the horizontal component of Earth's magnetic field is 25×10^{-6} T then, calculate the current which gives a deflection of 60°.

Answer any two of the following:- **2x3=6**

7. Give the properties of dia / para /ferromagnetic materials
8. Discuss the conversion of galvanometer into an ammeter.
9. A circular coil with cross-sectional area 0.1 cm^2 is kept in a uniform magnetic field of strength 0.2 T. If the current passing in the coil is 3 A and plane of the loop is perpendicular to the direction of magnetic field. Calculate (a) total torque on the coil (b) total force on the coil.

Answer the following :- **2x5=10**

10. (a) Discuss the working of cyclotron in detail.

(OR)

(b) Deduce the relation for the magnetic field at a point due to an infinitely long straight conductor carrying current using Biot-Savart law.

11. i) State Ampere's circuital law.
ii) An electron moving perpendicular to a uniform magnetic field 0.500 T undergoes circular motion of radius 2.50 mm. What is the speed of electron?

ALL THE BEST

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Answer key attached in next page!!!

This page is to prevent seeing answer key

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ANSWER KEY

<table>
<tr><th>Q NO</th><th>ANSWERS</th><th>MA</th></tr>
<tr><td>1.</td><td>(B) 1.2 Am^2</td><td>1</td></tr>
<tr><td>2.</td><td>(C) $\frac{q}{2m}$</td><td>1</td></tr>
<tr><td>3.</td><td>(D) Weber</td><td>1</td></tr>
<tr><td>4.</td><td>The number of magnetic field lines crossing any area normally is defined as magnetic flux ϕ_B through the area. Mathematically, the magnetic flux through a surface of area A in a uniform magnetic field B is defined as
$\phi_B = \vec{B} \cdot \vec{A} = BA\,cos\theta$</td><td>2</td></tr>
<tr><td>5.</td><td>the magnitude of magnetic field $\overrightarrow{dB}$ at a point P at a distance r from the small elemental length taken on a conductor carrying current varies
(i) directly as the strength of the current I
(ii) directly as the magnitude of the length element $\overrightarrow{dl}$
(iii) directly as the sine of the angle θ between $\overrightarrow{dl}$ and $\hat{r}$.</td><td>2</td></tr>
<tr><td>6.</td><td>$I = \frac{2RB_H}{\mu_o N} tan\theta$
I = 0.082 A</td><td>2</td></tr>
<tr><td>7.</td><td>
<table>
<tr><th>Property</th><th>Diamagnetic</th><th>Paramagnetic</th><th>Ferromagnetic</th></tr>
<tr><td>Field Response</td><td>Weakly repelled</td><td>Weakly attracted</td><td>Strongly attracted</td></tr>
<tr><td>Magnetization</td><td>Opposite to field</td><td>Same as field</td><td>Strongly in field direction</td></tr>
<tr><td>Susceptibility</td><td>Small and Negative</td><td>Small and Positive</td><td>High and Positive</td></tr>
<tr><td>Permeability</td><td>(Slightly less than 1)</td><td>(Slightly more than 1)</td><td>(Much greater than 1)</td></tr>
<tr><td>Temperature</td><td>Independent</td><td>Inversely proportional</td><td>Depends on Curie temp</td></tr>
<tr><td>Effect of Magnet</td><td>Moves toward weaker field</td><td>Moves toward stronger field</td><td>Moves strongly toward stronger field</td></tr>
<tr><td>Examples</td><td>Copper, Water, Bismuth, Gold</td><td>Aluminum, Oxygen, Platinum</td><td>Iron, Cobalt, Nickel, Steel</td></tr>
</table>
</td><td>3</td></tr>
<tr><td>8.</td><td>$V_{galvanometer} = V_{shunt}$
$I_g = \frac{S}{S+R_g} I$
$\frac{R_g S}{R_g+S} = R_a$</td><td>3</td></tr>
</table>

9.	(a) zero (b) zero (c) 0.6 x $10^{-23}N$	**3**
10. a	Diagram Principle : When a charged particle moves perpendicular to the magnetic field, it experiences magnetic Lorentz force. Working applications	**5**
10. b	Diagram $\overrightarrow{dB} = \frac{\mu_o}{4\pi}\frac{Idl\ sin\theta}{r^2} \quad \Rightarrow \quad \overrightarrow{dB} = \frac{\mu_o}{4\pi}\frac{Id\Phi}{r}\hat{n}$ $d\vec{B} = \frac{\mu_o I}{4\pi a} cos\phi d\phi\ \hat{n}$ $\overrightarrow{B} = \int_{-\phi_1}^{\phi_2} \frac{\mu_o I}{4\pi a} cos\phi d\phi\ \hat{n}$ $\vec{B} = \frac{\mu_o I}{2\pi a}\hat{n}$	**5**
11	i) The line integral of magnetic field over a closed loop is μ_0 times net current enclosed by the loop**.** $\oint_c \vec{B}.\vec{dl} = \mu_0 I$ ii) $v = \lvert q \rvert \frac{rB}{m}$ $v = 2.195\ X\ 10^8\ ms^{-1}$	**5**

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