LECTURE BASED PROBLEM SHEET

TOPIC: Magnetic Effects of Electric Current **FACULTY: MONI KAKATI**

Q.1. Two thin long parallel wires separated by a distance b are carrying current i each. The magnitude of the force per unit length exerted by one wire on the other is

(a) $\frac{\mu_0\, i^2}{b^2}$ (b) $\frac{\mu_0\, i^2}{2\times b}$
(c) $\frac{\mu_0\, i^1}{2\times b}$ (d) $\frac{\mu_0\, i^1}{2\times b^2}$

Q.2. Three long straight wires are connected parallel to each other across a battery of negligible internal resistance. The ratio of their resistances are 3: 4: 5. What is the ratio of distance of middle wire from the others if the net force experienced by it is zero?

(a) 4: 3 (b) 3: 1
(c) 5: 3 (d) 2 : 3

Q.3. A circular current carrying coil has radius R. the distance from the centre of the coil on the axis where the magnetic induction will be $\frac{1}{8}$ th of its value at the centre of the coil is

(a) $R\sqrt{3}$ (b) $2R\sqrt{3}$
(c) $R/\sqrt{3}$ (d) $2R/\sqrt{3}$

Q.4. Two electrons move parallel to each other with equal speed v. The ratio of magnetic and electrical forces between them is

(a) $\frac{v}{c}$ (b) $\frac{c}{v}$ (c) $\frac{v^2}{c^2}$ (d) $\frac{c^2}{v^2}$

Q.5. A long wire carries a current of 20 A along the axis of solenoid. The field due to the solenoid is 4mT. The resultant field at a point 3mm from the axis of solenoid is

(a) 1.33 mT (b) 4.2 mT
(c) 2.1 mT (d) 8.4 mT

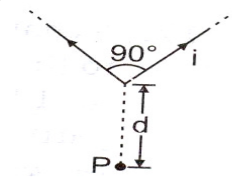
Q.6. A non conducting thin disc of radius r charged uniformly over one side with surface density σ rotates about its axis with an angular velocity ω. The magnetic induction at the centre is

(a) $\frac{\mu_0\sigma\omega R}{2}$ (b) $2\mu_0\sigma\omega R$
(c) $\frac{\mu_0\omega R^2}{2}$ (d) None of these

Q.7. A particle of specific charge α moving from the origin under the action of an electric field $\vec{E} = E_0\,\hat{\imath}$ and magnetic field $\vec{B} = B_0\,\hat{k}$. Its velocity at (x, 0, 0) is $4\hat{\imath}+3\,\hat{\jmath}$. The value of x is

(a) $\frac{13\alpha E_0}{2\,B_0}$ (b) $\frac{16\alpha E_0}{E_0}$
(c) $\frac{25}{2\alpha E_0}$ (d) $\frac{5\alpha}{2B_0}$

Q.8. Find the magnetic field at P due to the arrangement shown



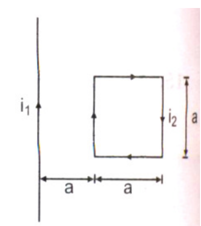
(a) $\frac{\mu_0 i}{\sqrt{2}\pi d}\left(1-\frac{1}{\sqrt{2}}\right)\otimes$

(b) $\frac{2\mu_0 i}{\sqrt{2}\pi d}\otimes$

(c) $\frac{\mu_0 i}{\sqrt{2}\pi d}\otimes$

(d) $\frac{\mu_0 i}{\sqrt{2}\pi d}\left(1+\frac{1}{\sqrt{2}}\right)\otimes$

Q.9. A current carrying square loop is placed near an infinitely long current carrying wire as shown in figure. The torque acting on the loop is



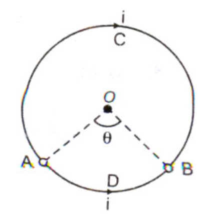
(a) $\frac{\mu_0}{2\pi}\left(\frac{i_1 i_2 a}{2}\right)\otimes$

(b) $\frac{\mu_0\, i_1 i_2 a}{2\pi}$

(c) $\frac{\mu_0\, i_1 i_2 a}{2\pi}$ ln (2)

(d) zero

Q.10. Equal current i flows in two segments of a circular loop in the directions shown in figure. Radius of the loop is a. Magnetic field at the centre of the loop is



(a) zero

(b) $\left(\frac{\pi-\theta}{\pi}\right)\frac{\mu_0 i}{2a}$

(c) $\left(\frac{2\pi-\theta}{\pi}\right)\frac{\mu_0 i}{2a}$

(d) $\left(\frac{\theta}{2\pi}\right)\frac{\mu_0 i}{2a}$

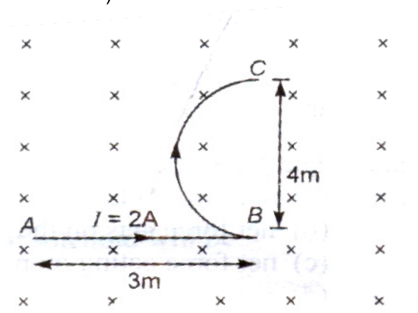
Q.11. Two particles X and Y having equal charges, after being accelerated through the same potential difference, enter a region of uniform magnetic field and describe circular paths of radii R_1 and R_2 respectively. The ratio of the mass of X to that of Y is

(a) $(R_1 / R_2)^{1/2}$ (b) R_2/ R_1
(c) $(R_1/ R_2)^2$ (d) R_1/R_2

Q.12. A particle of charge q and mass m moves in a circular orbit of radius r with angular speed ω. The ratio of the magnitude of its magnetic moment to that of its angular momentum depends on

(a) ω and q (b) ω q and m
(c) q and m (d) ω and m

Q.13. In the figure the force on the wire ABC in the given uniform magnetic field will be (B = 2 tesla)



(a) $4(3 + 2\pi)$ Nt (b) 20 Nt
(c) 30 Nt (d) 40 Nt

Q.14. A charged particle with specific charge s moves undeflected through a region of space containing mutually perpendicular and uniform electric and magnetic fields e and B. When the electric field is switched off, the particle will move in a circular path of radius

(a) $\frac{E}{Bs}$ (b) $\frac{Es}{B}$ (c) $\frac{Es}{B^2}$ (d) $\frac{E}{B^2 s}$

Q.15. An insulating rod of length l carries a charge q uniformly distributed on it. The rod is pivoted at one of is ends and is rotated at a frequency f about a fixed perpendicular axis. The magnetic moment of the rod is

(a) $\frac{\pi q f l^2}{12}$ (b) $\frac{\pi q f l^2}{2}$
(c) $\frac{\pi q f l^2}{6}$ (d) $\frac{\pi q f l^2}{3}$

Q.16. Equal currents are flowing in three infinitely long wires along positive x, y and z directions. The magnetic field at appoint (0, 0, - a) would be (i = current in each wire)

(a) $\frac{\mu_0 i}{2\pi a}(\hat{j} - \hat{\imath})$ (b) $\frac{\mu_0 i}{2\pi a}(\hat{\imath} - \hat{j})$
(c) $\frac{\mu_0 i}{2\pi a}(\hat{\imath} + \hat{j})$ (d) $\frac{\mu_0 i}{2\pi a}(-\hat{\imath} - \hat{j})$

ANSWER KEY

1.-b	2.-c	3.- a	4.-c	5.-b
6.-a	7.-c	8.-a	9.-d	10.-b
11.-c	12.-c	13.-b	14.-d	15.-d
16.-a				