DPP – 6 (Magnetic Field & Force)

Video Solution on Website:- https://physicsaholics.com/home/courseDetails/34

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Q 1. A circular coil of diameter 7cm has 24 turns of wire carrying current of 0.75A. The magnetic moment of the coil is
(a) $6.9 \times 10^{-2}\ amp - m^2$ (b) $2.3 \times 10^{-2}\ amp - m^2$
(c) $10^{-2}\ amp - m^2$ (d) $10^{-3}\ amp - m^2$

Q 2. A circular coil of wire n turns has a radius r and carries a current I. Its magnetic dipole moment is M. Now the coil is unwound and again rewound into a circular coil of half the initial radius and the same current is passed through is, then the dipole moment of this new coil is:
(a) M/2 (b) M/4
(c) M (d) 2M

Q 3. A wire of length l, carrying current i, is bent in circle of radius r, then magnetic moment of loop is
(a) $\frac{il^2}{2\pi}$ (b) $\frac{il^2}{4\pi}$
(c) $\frac{i^2 l}{4\pi}$ (d) $\frac{il}{4\pi}$

Q 4. A circular coil of radius 4 cm and of 20 turns carries a current of 3 amperes. It is placed in a magnetic field of intensity of 0.5 $weber/m^2$. The magnetic dipole moment of the coil is
(a) $0.15\ amp - m^2$ (b) $0.3\ amp - m^2$
(c) $0.45\ amp - m^2$ (d) $0.6\ amp - m^2$

Q 5. The final torque on a coil having magnetic moment 25 A-m^2 in a 5 T uniform external magnetic field (initially plane of coil is perpendicular to magnetic field), if the coil rotated through an angle of `$60^0$` under the influence of the magnetic field is
(a) 216.5 N-m (b) 108.25 N-m
(c) 102.5 N-m (d) 258.1 N-m

Q 6. The deflection in a moving coil galvanometer is
(a) directly proportional to the torsional constant
(b) directly proportional to the number of turns in the coil
(c) inversely proportional to the area of the coil
(d) inversely proportional to the current flowing

Q 7. A current of $10^{-5}A$ produced a deflection of 10^o in a moving coil galvanometer. A current of $10^{-6}amp$ in the same galvanometer produces a deflection of
(a) 1^o (b) 2^o
(c) 3^o (d) 4^o

Q 8. Two galvanometers A and B require 3mA and 5mA respectively to produce the same deflection of 10 divisions. Then
(a) A is more sensitive than B
(b) B is more sensitive than A
(c) A and B are equally sensitive
(d) Sensitiveness of B is 5/3 times that of A

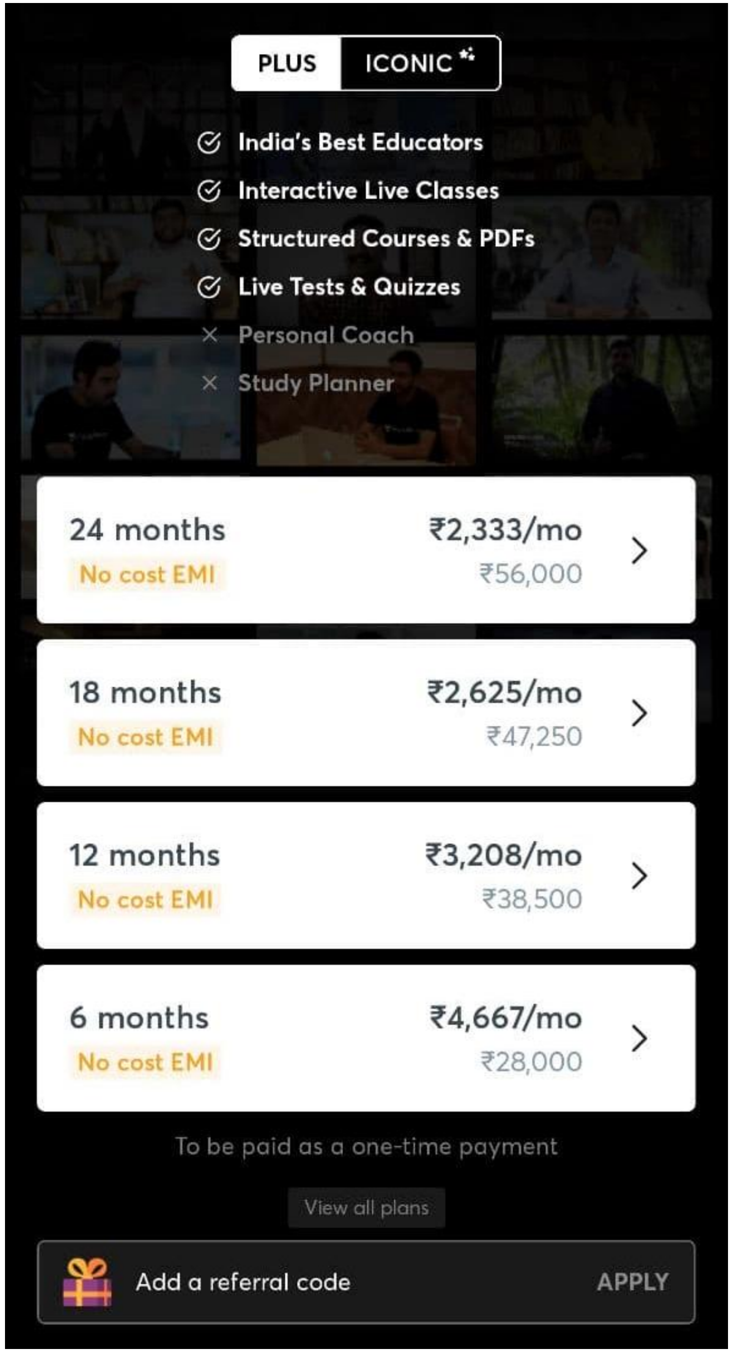
Q 9. The current sensitivity of a moving coil galvanometer is 10 div/mA and voltage sensitivity is 20 div/V. Find the resistance of the galvanometer
(a) 1000Ω (b) 500Ω
(c) 100Ω (d) 50Ω

Q 10. In an attempt to increases the current sensitivity of a moving coil galvanometer, it is found that its resistance becomes double while the current sensitivity increases by 10%. The voltage sensitivity of the galvanometer changes by
(a) 40% (b) - 45%
(c) 55% (d) - 55%

Q 11. The current sensitivity of a moving coil galvanometer can-not be increased by
(a) Increasing the magnetic field
(b) Increasing the area of the deflecting coil
(c) Increasing the number of turns in the coil
(d) Increasing the restoring couple of the coil

Answer Key

Q.1 a	Q.2 a	Q.3 b	Q.4 b	Q.5 b
Q.6 b	Q.7 a	Q.8 a	Q.9 b	Q.10 b
Q.11 d				



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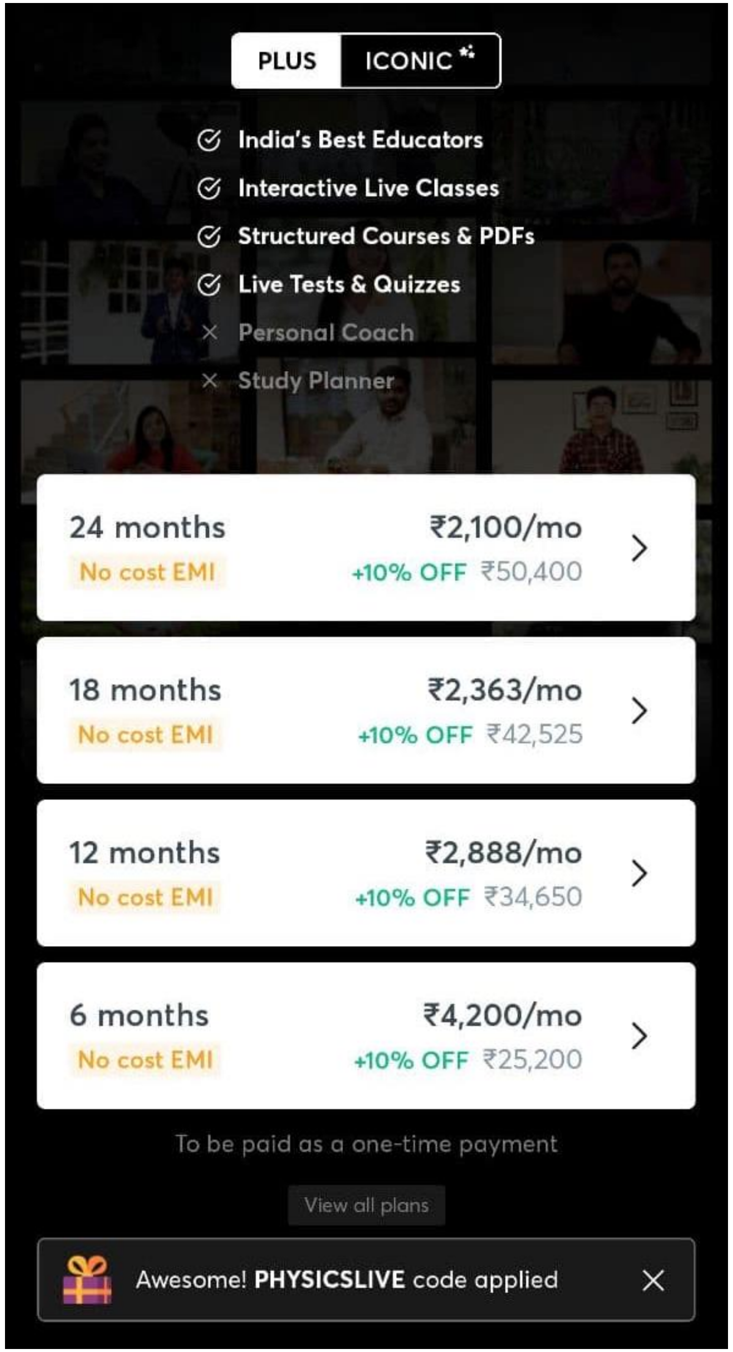

Written Solution

DPP- 6 Magnetic Moment of loop & Moving Coil Galvanometer

By Physicsaholics Team

Solution: 1

$d = 7\,cm$

$r = \frac{7}{2}\,cm = \frac{7}{2} \times 10^{-2}\,m$

$M = NIA$

$M = 24 \times 0.75 \times \pi \times \left(\frac{7}{2}\right)^2 (10^{-2})^2$

$M = 24 \times \frac{3}{4} \times \pi \times \frac{49}{4} \times 10^{-4}$

$M = 692.37 \times 10^{-4}$

$$\boxed{M = 6.92 \times 10^{-2}\ \text{amp-m}^2}$$

Ans. a

Solution: 2

length of wire $= l = n(2\pi r)$

& $M = NIA = nI(\pi r^2)$

$M = nI\pi r^2$ — (1)

Now new radius $= r/2$

$l = n(2\pi r) = n_2(2\pi \frac{r}{2})$

$n_2 = 2n$

$M_2 = n_2 I A = (2n)(I)(\pi (\frac{r}{2})^2)$

$M_2 = 2nI\pi \frac{r^2}{4 \cdot 2} = \frac{nI\pi r^2}{2}$

$$\boxed{M_2 = \frac{M}{2}}$$

Ans. a

Solution: 3

Let radius of loop = r

$$l = 2\pi r$$

$$r = \frac{l}{2\pi}$$

$$M = IA = i(\pi r^2)$$

$$M = i\left(\pi\left(\frac{l}{2\pi}\right)^2\right)$$

$$M = \frac{il^2}{4\pi}$$

Ans. b

Solution: 4

$$M = NIA$$

$$= 20 \times 3 \times \pi \times (4 \times 10^{-2})^2$$

$$= 20 \times 3 \times \pi \times 16 \times 10^{-4}$$

$$M = 60 \times \pi \times 16 \times 10^{-4}$$

$$M = 960 \times \pi \times 10^{-4}$$

$$M = 3014.4 \times 10^{-4}$$

$$\boxed{M = 0.3 \text{ amp-m}^2}$$

Ans. b

Solution: 5

$$\tau = MB \sin\theta$$

$$= 25 \times 5 \times \sin 60^\circ$$

$$= 125 \times \frac{\sqrt{3}}{2}$$

$$\boxed{\tau = 108.25 \ N\text{-}m^2}$$

Ans. b

Solution: 6

$$\theta = \frac{NiAB}{C};$$

N = no. of turns
i = current
A = Area
B = Magnetic field strength
C = Torsional constant of coil

$$\theta \propto N$$

Ans. b

Solution: 7

$$\theta = \frac{NIAB}{C}$$

$$\theta \propto I$$

$$\frac{\theta_1}{\theta_2} = \frac{I_1}{I_2} \Rightarrow \frac{10^\circ}{\theta_2} = \frac{10^{-5}}{10^{-6}}$$

$$\theta_2 = \frac{10^{-6}}{10^{-5}} \times 10^\circ$$

$$\theta_2 = 10^{-1} \times 10^\circ$$

$$\boxed{\theta_2 = 1^\circ}$$

Ans. a

Solution: 8

Sensitivity 'S'

$$S = \frac{\theta}{i} = \frac{NIBA}{iC}$$

θ = same.

$$S \propto \frac{1}{i}$$

$$\frac{S_A}{S_B} = \frac{i_B}{i_A}$$

$$\frac{S_A}{S_B} = \frac{5\,mA}{3\,mA}$$

$$\frac{S_A}{S_B} = \frac{5}{3}$$

$$\boxed{S_A = \frac{5}{3} S_B}$$

$$\boxed{S_A > S_B}$$

Ans. a

Solution: 9

$$S_I = 10 \text{ div/mA}$$
$$= 10 \text{ div}/10^{-3} A$$
$$S_I = 10^4 \text{ div/A}$$
$$\& \; S_V = 20 \text{ div/V}$$

$$S_V = \frac{\theta}{V} \quad \& \quad S_I = \frac{\theta}{I}$$
$$S_V = \frac{\theta}{IR}$$
$$\frac{S_V}{S_I} = \frac{\theta/IR}{\theta/I} = \frac{1}{R}$$

$$\frac{S_V}{S_I} = \frac{1}{R} \Rightarrow \frac{20}{10^4} = \frac{1}{R}$$

$$R = \frac{10^4}{20} = \frac{10000}{20}$$

$$\boxed{R = 500\,\Omega}$$

Ans. b

Solution: 10

$$S_I = \frac{\theta}{I} \; ; \; S_V = \frac{\theta}{V} = \frac{\theta}{IR}$$

$$R = \frac{V}{I}$$

New current $I_2 = 1.5 I$

New resistance $R_2 = 2R$

$$2R = \frac{V_2}{1.5 I}$$

$$V_2 = 3 IR$$

$$V_2 = 3V$$

Current sensitivity $= S_I = \frac{\theta}{I} = \frac{NBA}{C}$

New current sensitivity $= S_I' = 1.1 S_I = \frac{1.1 NBA}{C}$

initial voltage sensitivity $= S_V = \frac{\theta}{V} = \left(\frac{\theta}{I}\right) \times \frac{1}{R} = \frac{NBA}{CR}$

New voltage sensitivity $= S_V' = \left(\frac{\theta}{I}\right)' \times \frac{1}{R} = \frac{1.1 NBA}{C(2R)}$

($\because$ New $R' = 2R$)

$$S_V' = \frac{1.1}{2} \frac{NBA}{CR} = 0.55 \frac{NBA}{CR}$$

$$\boxed{S_V' = 0.55 S_V}$$

$$\boxed{\Delta S_V = -45\%}$$

Ans. b

Solution: 11

Current Sensitivity

$$S_I = \frac{NAB}{C};$$

N = no. of turns

A = Area

B = Magnetic field strength

C = Torsional constant of coil

$$S_I \propto \frac{1}{C}$$

On increasing restoring couple, current sensitivity will decrease.

Ans. d

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Chalo Niklo