DPP – 5

CLASS – 12th

TOPIC – Magnetic Dipole and Moving Coil Galvanometre

Q.1 A galvanometer has a resistance of 100 ohm. A difference of potential of 50 millivolt between its terminals gives a full scale deflection. Calculate shunt resistance, which will enable the instrument to read upto 5 ampere.

Q.2 An ammeter of resistance 100 Ω can measure a maximum current of 5 mA. What will you do to measure maximum current of 5 A with it?

Q.3 A galvanometer has a resistance of 60 Ω and a full scale deflection is produced by 1.0 mA. How will yo convert it into (a) an ammeter to read 1 A (full scale) and (b) voltmeter to read 3 V (full scale) ?

Q.4 A moving coil galvanometer of resistance 10 ohm produces full scale deflection, when a current of 25 mA is passed through it. Describe showing full calculations, how will you convert the galvanometer into (a) a voltmeter reading upto 120 V (b) an ammeter reading upto 20 A.

Q.5 Estimate the torque on a closed current loop placed in the magnetic field B. What is the main function of soft iron used in a moving coil galvanometer?

Q.6 State the principle of moving filed in a moving coil galvanometer?

Q.7 Give two factors by which the current sensitivity of a moving coil galvanometer can be increased.

Q.8 How can a galvanometer be converted into an ammeter?

Or

How will you convert a moving coil galvanometer into an ammeter?

Q.9 It is desired to pass only 5% of the current through a galvanometer of resistance 95 Ω . What shunt resistance should be connected across it?

Q.10 A galvanometer has a resistance of 50 ohm. A resistance of 5 ohm is connected across its terminals. What part of total current will flow through the galvanometer?

Q.11 A galvanometer coil has a resistance of 15 Ω and the meter shows full scale deflection for a current of 4 mA. How will you convert the meter into an ammeter of range 0 to 6 A?

SOLUTION

(PHYSICS) **MOVING CHARGE MAGNETISM**

DPP – 05

CLASS – 12th

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Sol.1. Here, V = 50m V = 50×10^{-3} V ; G = 100 Ω

$$\therefore \quad I_g = \frac{V}{G} = \frac{50 \times 10^{-3}\ V}{100\ \Omega} = 5 \times 10^{-4}\ A$$

Now, $$S = \frac{I_g G}{I - I_g} = \frac{5 \times 10^{-4} \times 100}{5 - 5 \times 10^{-4}} = 0{\cdot}01\ \Omega$$

Sol.2. The given ammeter may be considered as a galvanometer of resistance 100 2, which can measure a maximum current of 5 mA. Thus,

G = 100Ω ; I_g = 5 mA = 5×10^{-3} A and I = 5 A

For this, a suitable small resistance S has to be connected in parallel to the coil of the given galvanometer. It is given by

$$S = \frac{I_g \times G}{I - I_g} = \frac{5 \times 10^{-3} \times 100}{5 - 5 \times 10^{-3}} = 0{\cdot}1\ \Omega$$

Sol.3. Here, G = 60Ω ; I_g = 1.0m A = 10^{-3} A

(a) To enable galvanometer resistance,

$$S = \frac{I_g \times G}{I - I_g} = \frac{10^{-3} \times 60}{1 - 10^{-3}} = 0{\cdot}06\ \Omega$$

$= 0{\cdot}06\ \Omega$ **(in parallel)**

(b) To enable galvanometer to read 3 V:

Here, V =1.5 V

The required resistance,

$$R = \frac{V}{I_g} - G = \frac{3}{10^{-3}} - 60$$

$= 2{,}940\ \Omega$ **(in series)**

Sol.4. Here, G = 10Ω ; I_g = 25 mA = 25 10^{-3}A

(a) To convert the galvanometer into voltmeter reading upto 120 V. To convert a galvanometer into voltmeter of range V, a large resistance R has to be connected in series to it. The value of R is given by

$$R = \frac{V}{I_g} - G$$

Here, $V = 120$ volt

$\therefore$ $$R = \frac{120}{25 \times 10^{-3}} - 10 = \mathbf{4,790\ \Omega}$$

(b) To convert galvanometer into ammeter reading upto 20 A. To convert a galvanometer into ammeter of range I, a small resistance S has to be connected in parallel to it. The value of S is given by

Sol.5. When a closed current loop is suspended in magnetic field, torque on the coil is given by

$$\left|\vec{\tau}\right| = \left|\vec{M} \times \vec{B}\right| = n\,B\,I\,A \sin\theta,$$

where the letters have their usual meanings.

The use of the soft iron core strengthens the magnetic flux linked with the coil.

Sol.6. It is based on the principle that when a current carrying conductor is placed in magnetic field, it experiences a torque

Sol.7. current sensitivity $= \frac{n\,B\,A}{k}$,

where the letters have their usual meanings. Since n and A cannot be increased beyond a limit, the current sensitivity may be increased by (i) increasing B and (ii) decreasing k.

Sol.8. A galvanometer can be converted into an ammeter by connecting a suitable small resistance (called shunt) in parallel to it

Sol.9. Here, $G = 95\Omega$

$$I_g = \frac{5}{100} I \quad \text{or} \quad I = 20\, I_g$$

Now, $$S = \frac{I_g\, G}{I - I_g} = \frac{I_g \times 95}{20\, I_g - I_g} = \mathbf{5\ \Omega}$$

Sol.10. We know, $$S = \frac{I_g\, G}{I - I_g}$$

or $$\frac{I_g}{I} = \frac{S}{G + S}$$

Here, $G = 50\ \Omega$ and $S = 5\ \Omega$

$\therefore$ $$\frac{I_g}{I} = \frac{5}{50 + 5} = \mathbf{\frac{1}{11}}$$

Sol.11. Here, , G = 15 Ω; I_g = 4 mA = 4 × 10^{-3} A ; I = 6 A

To convert a galvanometer into an ammeter, a small resistance S has to be connected in parallel to the coil of the galvanometer. Then,

$$S = \frac{I_g\ G}{I - I_g} = \frac{4 \times 10^{-3} \times 15}{6 - 4 \times 10^{-3}} = \mathbf{0 \cdot 01}\ \Omega$$