

Answer on Question 59060, Physics, Electric Circuits

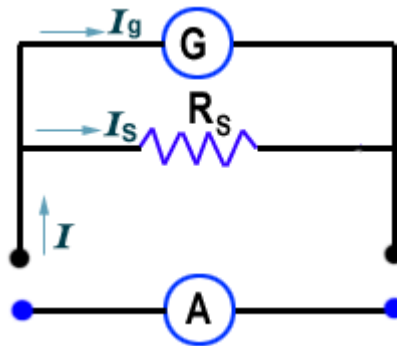
Question:

A galvanometer of resistance $120\ \Omega$ shows a full scale deflection with a current of $0.0005\ \text{A}$. How would you convert it to an ammeter that reads a maximum current of $5\ \text{A}$?

- a) connect $2000\ \Omega$ in parallel to it
- b) connect $200.12\ \Omega$ in series to it
- c) connect $20.10\ \Omega$ in series to it
- d) connect $0.012\ \Omega$ in parallel to it

Solution:

Galvanometer can be converted into an ammeter by shunting it with a very small resistance as we can see in the scheme below:



Let the resistance of galvanometer be R_g and it gives full scale deflection when current I_g is passed through it. Then, from the Ohm's law we can write the potential difference across the galvanometer:

$$V_g = I_g R_g.$$

Let a shunt of resistance R_s is connected in parallel to galvanometer and total current through the circuit is I . Then, from the Kirchhoff's first law we can write the current through the shunt:

$$I_s = I - I_g.$$

Then, the potential difference across the shunt will be:

$$V_s = I_s R_s = (I - I_g) R_s.$$

But, potential difference across the galvanometer and shunt resistance are equal, so we can write:

$$(I - I_g) R_s = I_g R_g.$$

From this formula, we can find the shunt resistance R_s :

$$R_s = \frac{I_g}{I - I_g} R_g = \frac{0.0005 \text{ A}}{5 \text{ A} - 0.0005 \text{ A}} \cdot 120 \Omega = 0.012 \Omega.$$

Answer:

d) connect 0.012Ω in parallel to it