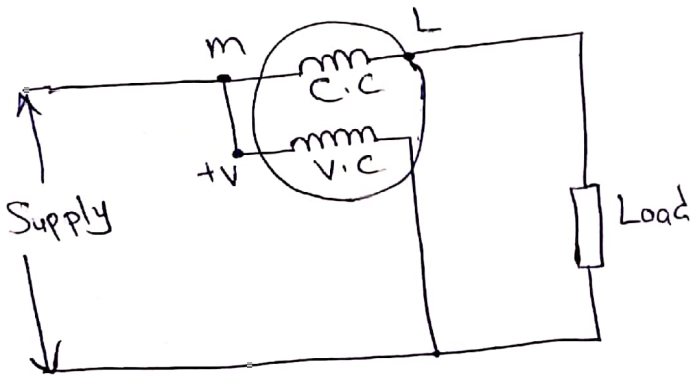
Wattmeter:-

"A wattmeter is an instrument for measuring electrical power in a circuit"

The below fig shows typical connections of a wattmeter used for measuring power supplied to a load. The instrument has two coils.

i):- a current coil, which is connected in series with the load like an ammeter. and,

2):- a voltage coil, which is connected in parallel with the load, like a voltmeter.



Problem:-

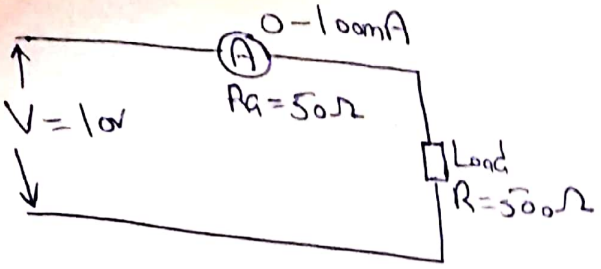
An ammeter has a fsd of 100mA and a resistance of 50Ω. The ammeter is used to measure the current in a load of resistance 500Ω when the supply voltage is 10V Calculate:-

a):- expected ammeter reading.

b):- The actual current in the ckt.

c):- The power dissipated in the ammeter

d):- The power dissipated in the load.



a):- expected ammeter reading = $\frac{V}{R+R_a}$

as we are neglecting R_a

$= \frac{10}{500}$ = 20mA

b):- Actual ammeter reading :-

$= \frac{V}{R+R_a} = \frac{10}{500+50}$ = 18.18mA

c):- Power dissipated in ammeter:-

$P_a = I^2 R_a = (18.18 \times 10^{-3})^2 (50)$

$P_a = 16.53mW$

d):- Power dissipated in load:-

$P_L = I^2 R = (18.18 \times 10^{-3})^2 (500)$ = 165.3mW

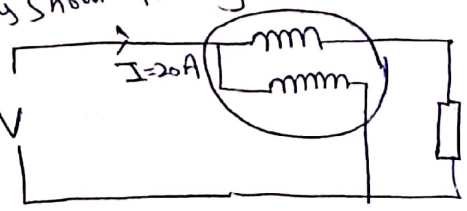
problem:-

a):- A current of 20A flows through a load having a resistance of 2Ω. Determine the power dissipated in the load:-

Soln:- Power dissipated in the load, $P = I^2 R$

$= (20)^2 (2)$ = 800W

b):- A wattmeter whose current coil resistance is 0.01Ω is connected as shown in fig below. Determine the wattmeter reading.



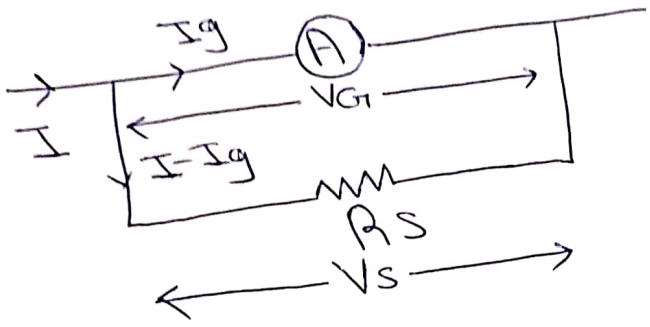
$P = I^2 (R_S + R_L)$

$P = (20)^2 (0.01+2)$

P = 804W

Problem 1 :-

A galvanometer gives a F.S.D when the current is 40mA and its resistance is 25Ω. Calculate the value of Shunt to be connected in parallel with the meter to enable it to be used as an ammeter for measuring currents upto 50A.



Given Data:-

$R_G = 25\Omega$, $I = 50A$

$I_g = 40mA$

Required :-

$R_S = ?$

Solution :-

As $V_G = V_S$

$I_g R_g = (I - I_g) R_S$

$$R_S = \frac{I_g R_g}{I - I_g}$$

$$R_S = \frac{(0.04)(25)}{50 - 0.04}$$

$$\boxed{R_S = 0.02\Omega}$$ Ans:-

Problem 2:-

A galvanometer gives FSD for a current of 10mA. Neglecting the resistance of the instrument, calculate the appropriate value of series resistance needed to enable the instrument to enable the instrument to measure up to:-

(a):- 20V

b):- 100V.

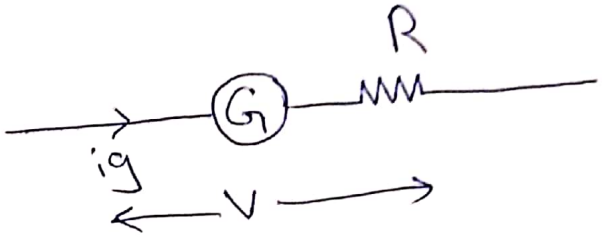
Given Data:-

$I_g = 10mA$

$V = 20v$

neglect (G_1)

$\Rightarrow G_1 = 0\Omega$



Required:-

$R = ?$

Solution:-

$$V = i_g(G+R)$$

$$\frac{V}{i_g} = G+R$$

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

(a):- $$R = \frac{20}{0.01} - 0$$

$$\boxed{R = 2k\Omega}$$ Ans:-

b):- $$R = \frac{100}{10\times10^{-3}} - 0$$

$$\boxed{R = 10k\Omega}$$ Ans:-

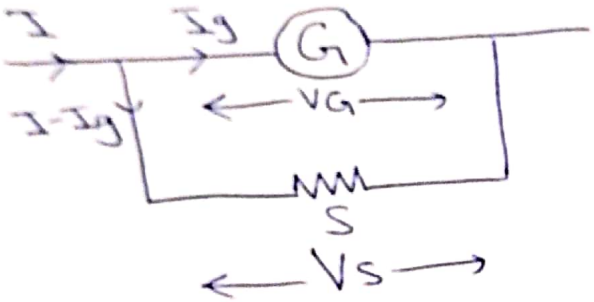
Problem 3:-

A meter of resistance 50Ω has a fsd of 4mA Determine the value of Shunt resistance required in order that fsd should be:-

a):- 15mA

b):- 20A

Given Data:-



$G = 50\Omega$

$I_g = 4mA$

Required:-

$S = ?$

Solution:-

$$S = \frac{I_g G}{I - I_g}$$

a):- $I = 15mA$

$$S = \frac{(0.004)(50)}{(0.015)-(0.004)}$$

$$S = \frac{0.2}{0.011} \Rightarrow \boxed{S = 18.18\Omega}$$ Ans:-

b):- $I = 20A$

$$S = \frac{(0.2)}{20-0.004}$$

$$S = \frac{0.2}{19.996}$$

$$\boxed{S = 0.010\Omega}$$ Ans:-

Problem 4:-

A moving coil instrument having a resistance of 20Ω gives a fsd when the current is 5mA. Calculate the value of resistance to be connected in series with the instrument so that it can be used as a voltmeter for measuring p.d upto 200V.

Given Data:-

$G_1 = 50\Omega$

$I_g = 5mA$

$V = 200V$

Required:-

$R = ?$

Solution:-

In order to convert it into voltmeter, we will use:-

$$V = I_g(G_1 + R)$$

$$\frac{V}{i_g} = G_1 + R$$

$$R = \frac{200}{5 \times 10^{-3}} - 50$$

$$R = 40{,}000 - 50$$

$$\boxed{R = 39.95k\Omega}$$ Ans:-