Homework 3

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Elec Measurement (PIV)

3.14 The sensitivity of a galvanometer is listed by the manufacturer as 25-μA full scale. The full-scale rotation of the pointer is 45 deg. Determine the sensitivity S of the galvanometer by using the definition of sensitivity given in Eq. 3.13.

Formula : $\theta = Si$

$$\frac{\pi}{4} = S(25\times10^{-6}\ A)$$

$$\therefore\quad S = 10{,}000\pi\ \text{rad/A}$$

ดังนั้น ค่า Sensitivity คือ $10{,}000\pi$ rad/A ※

3.15 A galvanometer with a 40-Ω coil is rated at 10-mA full scale. Determine the required shunt resistance if it is to be used to measure a current of

(a) 100 mA (c) 2 A
(b) 0.5 A (d) 20 A

โจทย์กำหนด $i_m = 10$ mA, $R_m = 40\ \Omega$

Formula : $R_{sh} = \dfrac{i_m}{i_i - i_m} \times R_m$

(a) $i_i = 100$ mA

จะได้ $R_{sh} = \dfrac{10\times10^{-3}}{(100-10)\times10^{-3}} \times 40 = 4.445\ \Omega$ ※

(b) $i_i = 0.5$ A

จะได้ $R_{sh} = \dfrac{10\times10^{-3}}{0.5-(10\times10^{-3})} \times 40 = 0.816\ \Omega$ ※

(c) $i_i = 2$ A

จะได้ $R_{sh} = \dfrac{10\times10^{-3}}{2-(10\times10^{-3})} \times 40 = 0.201\ \Omega$ ※

(d) $i_i = 20$ A

จะได้ $R_{sh} = \dfrac{10\times10^{-3}}{20-(10\times10^{-3})} \times 40 = 0.02001\ \Omega$ ※

3.16 Prepare a graph showing the series resistance needed to convert a 50-μA full-scale galvanometer with a coil resistance of 40 Ω to a multimeter with full-scale voltages that range from 10 mV to 100 V.

formula : $R_{sr} = \frac{V_m^*}{i_m^*} - R_m$ $\Rightarrow$ Tandaan ko

- $i_m^* = 50 \times 10^{-6}$ A
- $R_m = 40\ \Omega$

① $V_m^* = 10$ mV

; $R_{sr} = \frac{10 \times 10^{-3}}{50 \times 10^{-6}} - 40 = 160\ \Omega$ (0.16, 10)

② $V_m^* = 100$ mV

; $R_{sr} = \frac{100 \times 10^{-3}}{50 \times 10^{-6}} - 40 = 1960\ \Omega = 1.96\ k\Omega$ (1.96, 100)

③ $V_m^* = 1$ V

; $R_{sr} = \frac{1}{0.02 \times 10^{-6}} - 40 = 19960\ \Omega = 19.96\ k\Omega$ (19.96, 1000)

④ $V_m^* = 10$ V

; $R_{sr} = \frac{10}{50 \times 10^{-6}} - 40 = 199{,}960\ \Omega = 199.96\ k\Omega$ (199.96, 10000)

⑤ $V_m^* = 100$ V

; $R_{sr} = \frac{100}{50 \times 10^{-6}} - 40 = 1{,}999{,}960\ \Omega = 1{,}999.96\ k\Omega$ (1999.96, 100 000)