Manan Madan
2018UIC3087

Assignment (TDM)

Prob $C = \frac{A\varepsilon}{3.6\pi d}$

$$S = \frac{\partial C}{\partial d} = -\frac{A\varepsilon}{3.6\pi d^2}$$

given $A = 5cm^2$

$d = 1mm = 0.1cm$

$$S = \frac{5 \times 1}{3.6 \times \pi \times 10^{-2}}$$

$$S = -442.1 pF/cm$$

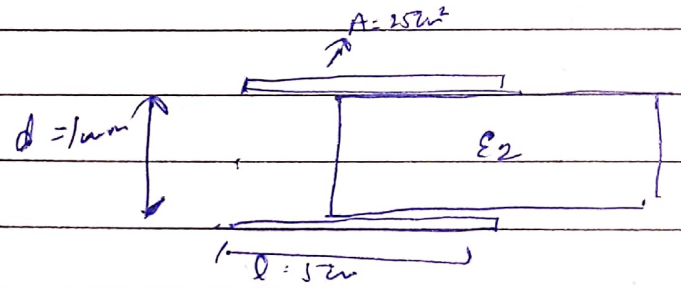
Prob $C = \frac{A\varepsilon_0}{3.6\pi d}$

$$S = \frac{\partial C}{\partial d} = -\frac{A\varepsilon}{3.6\pi d^2}$$

$A = \frac{\pi}{4}(2)^2 = \pi\, cm^2$ $\varepsilon = 1$ for air

$S = -444\ pf/cm.$

8.3



$$C = \frac{\varepsilon_0 \omega}{d}\left[\varepsilon_2 l - (\varepsilon_2 - \varepsilon_1) n\right] \qquad \omega = \text{width} = 5cm$$

here $\varepsilon_2 = 1$ $\varepsilon_0 = 1$

Case I $n = 0$

$$C = \frac{5}{0.1}[4 \times 5 - (4-1)0] = 1000pf = 1nf$$

Case 2 $x = 2.5$

$$C = \frac{5}{0.1}\left[4 \times 5 - (3 \times 2.5)\right] = 625\ pF$$

Case 3 $$C = \frac{5}{0.1}\left[4 \times 5 - (3 \times 6)\right] = 250\ pF$$

emf at cold junction or potentiometer

$$= 815 \times 0.041 = 33.415\ mV$$

Q12 a) Sensitivity of thermocouple $= \frac{20.68}{400 - 0} = 0.0517\ mV/°C$.

Reference Junction of 0°C is being used at 25°C.

$$E_{corr} = 0.0517 \times 25 = 1.293\ mV.$$

b) Indicated emf b/w hot & reference junctions at 25°C

$= 8.92\ mV$.

Difference of temp b/w hot & cold junction

$$= \frac{8.92}{0.0517} = 172.53°C$$

Reference junction temp at 25°C

$$172.53 + 25 = 197.53°C.$$

Exercise

Q12 T) Sensitivity $= \frac{45.14}{1100 - 0} = 0.041\ mV/°C$

the temp. diff b/w hot & cold junction is $840 - 25° = 815°C$

Inductive sensing element:

@ Ans 1) $R_{core} = \frac{R}{\mu_0 \mu_c r^2} = \frac{4 \times 2}{100 \times 1.2 \times 10^{-6} \times 10^{-2}}$

$= 6.6 \times 10^8$

$R_{armature} = \frac{R}{\mu_0 \mu_A A_t}$

$= \frac{4}{1.2 \times 10^{-6} \times 100 \times 0.1 \times 0.5}$

$= 0.66 \times 10^8$

$R_{gap_1} = \frac{2d_1}{\mu_0 \pi r^2} = 21.2 \times 10^8$

$R_{gap_2} = \frac{2d_2}{\mu_0 \pi r^2} = 0.636 \times 10^8$

$R_{T_1} = 28.5 \times 10^5 \qquad R_{T_2} = 7.95 \times 10^8$

$L_1 = \frac{n^2}{R_{T_1}} = 0.087 \text{ mH} \qquad L_2 = 0.05 \text{ mH}$

Ans 2) (i) Sensitivity $= \frac{fsd}{\text{displacement}} = \frac{1.5}{\delta x \times 10^{-4}}$

$= 1.5 \times 10^{-4} \text{ V/mm}$

$= 15000 \text{ V/m}$

(ii) Resolution $= \frac{1}{\text{total counts}} \times fsd = \frac{1}{100} \times 10 = 0.01 \text{V}$

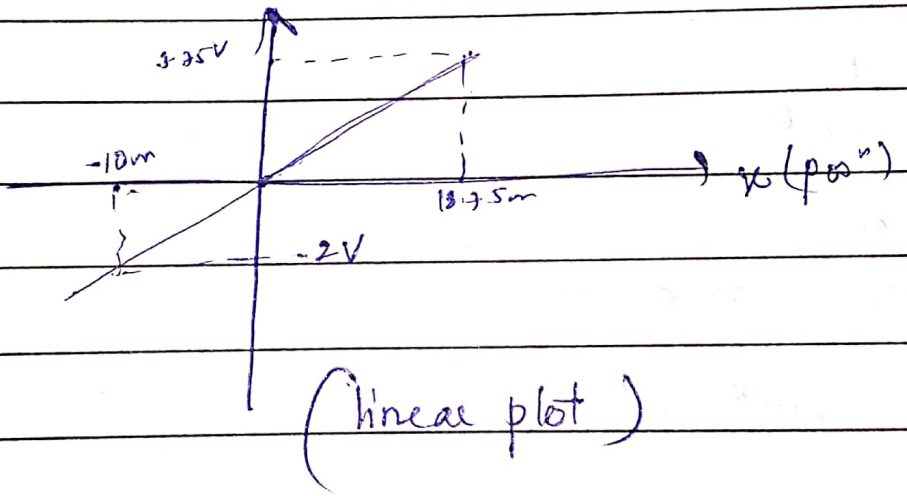
Q3) sensitivity $= \frac{5}{25} = 0.2\ V/mm$

a) $V = 0.2 \times 18.75 = 3.75\ V$

for 18.75 mm $V = 3.75$ V

& for -10 mm $V = -2$ V

b)



(linear plot)