Foundation for Advancement of Science & Technology

# ASSINGMENT#3 (23K-0609)

## CURRENT & RESISTANCE

(1)

Suppose that the material composing a fuse melts once the current density rises to 440 A/cm². What diameter of cylinder wire should be used for the fuse to limit the current to 0.552A?

$$\Delta J = 440 \times 100 \times 100 \ \frac{A}{cm^2} = 4400000 \ A/m^2$$

$d = 2r = ?$ $\quad \Delta I = 0.522A$

$$\because \Delta J = \frac{\Delta I}{A}$$

$$A = \frac{\Delta I}{\Delta J}$$

$$A = 1.186 \times 10^{-7}$$

$$\therefore \pi r^2 = 1.186 \times 10^{-7} \qquad \because A = \pi r^2$$

$$r^2 = \frac{1.186 \times 10^{-7}}{\pi}$$

$$r = \sqrt{\frac{1.186 \times 10^{-7}}{\pi}}$$

$$r = 1.992 \times 10^{-4}$$

$$\because 2r = d$$

$$\therefore d = 3.885 \times 10^{-4} \ m$$

Q#2

# QUESTION #2

$I = 115\,A$

$A = 31.2 \text{ milli } m^2 = 3.12 \times 10^{-5}\, m^2$

$t = ?$ length $= L = 85.5\,cm = 0.855\,m$

$n = 8.49 \times 10^{28}\, m^{-3}$

$\because I = \frac{Q}{t}$

$\because Q = nALe$

$\therefore t = \frac{nALe}{I}$

$t = \frac{8.49 \times 10^{28} (3.12 \times 10^{-5})(0.855)(1.6 \times 10^{-19})}{115}$

$t = 3.15 \times 10^{3}\, sec$

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# QUESTION #3

$\because R = \rho \cdot \frac{1}{A}$ & $C = \frac{A\epsilon_0}{d}$

$d = \frac{A\epsilon_0}{C}$

$d = \frac{A \times 8.85 \times 10^{-12}}{110 \times 10^{-12}}$

$d = 0.080\,A$

$$R = \frac{9.4 \times 0.080\ A}{A}$$

$$\rightarrow R = 0.756\ \Omega$$

## QUESTION #4

(a) $\because V = IR$

$R = V/I$

$R = 3.55i^2/i$

$R = 3.55 \times 2.4 \times 10^{-3}$

$R = 8.52 \times 10^{-3}\ \Omega$ Ans

(b) Alc to condition:-

$R = 16\ \Omega$

$I = V/R$

$I = 3.55i^2/16$

$i = 3.55i^2/16$

$i = 16/3.55$

$i = 4.51\ A$ Ans

## QUESTION #5

$\because P = VI$

$I = \frac{P}{V}$

$I = 7.5/9$

$I = 0.83\ A$

$\because I = Q/t$

$\therefore Q = It$


→ 6 hours total.

$t = 6$ hours →

$t = 6 \times 60 \times 60 = 21600$ sec.

$Q = 0.83 \times 21600$

$Q = 17928\ C$

Q is the charged passed through the wires.