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MATRIC NO: 15/ENG04/005

EEE 552 Assignment

a.) Since $E = \pi L = \frac{I}{r^2}$

$\therefore L = \frac{E}{\pi}$

considering reflection factor

$L = \frac{E}{\pi} \times$ reflection factor

$E = 44,000$ lux, reflection factor $= 85\% = 0.85$

$L = \frac{44,000}{\pi} \times 0.85$

$= 11904.79$

$= 11.905 \times 10^3 \, cd/m^2$

ii) $E = 0.22$ lux

$L = \frac{0.22}{\pi} \times 0.85$

$= 0.0595$

$= 59.52 \times 10^3 \, cd/m^2$

B) i) flux emitted by source

$\phi = I \times W = 120 \times 4\pi = 480\pi$ lumen

30% of light emitted by globe

$= 0.3 \times 480\pi = 144\pi$

flux emitted by globe $= 480\pi - 144\pi$

$= 336\pi$ lumen

luminance $= \frac{\text{flux emitted}}{\text{Area}}$

Area $= \pi d^2 = \pi \times (0.22)^2$

$= 0.152$

$\therefore$ luminance $= \frac{336\pi}{0.152} = 6944.57 \, lm/m^2$

ii) Candle Power = $\frac{\text{Lumen}}{\omega} = \frac{336\pi}{4\pi}$

$= 84\ Cd.$

c) $A = 75cm^2 = 75 \times 10^{-4}\ m^2$

$t = 2cm = 2 \times 10^{-2} m$

heat required $= mc\Delta\theta$

Density $= 0.55 g/cm^2$

Density $= \frac{m}{V}$

$\therefore m = (0.55) \times (75 \times 2)$

$= 82.5g$

$C = \frac{\varepsilon_o \varepsilon_r A}{t} = \frac{8.85 \times 10^{-12} \times 65 \times 75 \times 10^{-4}}{2 \times 10^{-2}}$

$= 21.57 \times 10^{-12} F$

$\omega = 2\pi f$

$= 2 \times \pi \times 20 \times 10^6$

$= 125.66 \times 10^6\ rad/s$

$p.f = \cos\phi = 0.04$

$\phi = \cos^{-1}(0.04) = 87.7^\circ$

$\delta = 90 - \phi = (90 - 87.7)^\circ$

$= 2.3^\circ$

heat required $= mc\Delta\theta$

$= 82.5 \times 0.255 \times (80 - 30)$

$= 1051.88\ Cal$

Total heat required $= 1051.88 \times 0.85$

$= 894.098\ Cal$

$1 cal = 4.186\ J\ (w/s)$

$894.098 = x$

$x = 894.098 \times 4.186 = 3742.7\ J$

$P = \frac{\text{Energy}}{\text{time}} = \frac{3742.7}{8 \times 60}$

$= 7.797\ W$

$$P_d = V^2 \omega C \tan\delta$$

$$7.797 = V^2 \times 125.66 \times 10^6 \times 21.57 \times 10^{-12} \times \tan 2.3^\circ$$

$$7.7977 = 1.08868 \times 10^{-4} V^2$$

$$V^2 = \frac{7.797}{1.08868 \times 10^{-4}}$$

$$V = 267.62V$$

$$P = IV\cos\phi$$

$$I = \frac{P}{V\cos\phi} = \frac{7.797}{267.62 \times 0.04}$$

$$= 0.7284A$$