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DEPT: ELECTRICAL/ELECTRONICS ENGR.

COURSE: EEE 552

ASSIGNMENT

(a) (i) $E = \bar{\pi}L = \frac{I}{r^2}$

$E = \bar{\pi}L$

Therefore, $L = E/\bar{\pi}$

Considering reflection factor;

$L = E/\bar{\pi} \times$ reflection factor

$L = \frac{44,000}{\bar{\pi}} \times \frac{85}{100} = 11.905 \times 10^3 \text{ cd/m}^2$

(ii) $L = \frac{0.22}{\bar{\pi}} \times \frac{85}{100} = 59.52 \times 10^3 \text{ cd/m}^2$

(b) (i) Flux emitted by source is given by

$\phi = I \times \omega$

$= 120 \times 4\bar{\pi}$ lumen

When 30% is absorbed, flux emitted by globe;

$120 \times 4\bar{\pi} \times 30/100 = 144\bar{\pi}$ lumen

Therefore, Flux emitted by globe $= (120 \times 4\bar{\pi}) - 144\bar{\pi}$

$= 336\bar{\pi}$ lumen

Luminance $= \frac{\text{Flux emitted}}{\text{Area}} = \frac{336\bar{\pi}}{\bar{\pi} \times (0.22)^2} = 6942 \text{ lumen/m}^2$

(ii) Candle Power, CP $= \frac{\text{lumen}}{\omega} = \frac{336\bar{\pi}}{4\bar{\pi}} = 84 \text{ cd}$

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

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

Heat required $= mc\Delta\theta$

Density $= m/v$

$m = 0.55 \frac{g}{cm^3} \times (75 \times 2) cm^3$

$= 82.5 g$

$C = \frac{\varepsilon_0 \varepsilon_r A}{t} = \frac{8.85 \times 10^{-12} \times 6.5 \times 75 \times 10^{-4}}{2 \times 10^{-2}} = 21.57 \times 10^{-12} F$

$w = 2\pi f = 2 \times \pi \times 20 \times 10^6 = 125.664 \times 10^6 rad/s$

Power factor $= \cos\phi = 0.04$

$\phi = \cos^{-1}(0.04) = 87.7°$

$\delta = 90 - \phi = 90 - 87.7° = 2.3°$

Heat required $= mc\Delta\phi$

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

$= 1051.88 cal$

Total Heat required $= 1051.88 \times \frac{85}{100} = 894.098 cal$

$1 cal = 4.186 (w-s) g$

$894.098 = x$

Power input $= 894.098 \times 4.186 = 3742.7 (w-s)$

$P = \frac{Energy}{time} = \frac{3742.7}{8 \times 60} = 7.797 W$

$P_d = V^2 w c \tan\delta$

$7.797 = V^2 \times 125.664 \times 10^6 \times 21.57 \times 10^{-12} \times \tan 2.3°$

$\frac{7.797}{1.08868 \times 10^{-4}} = V^2 \qquad V = 267.624$

$P = IV \cos\phi$

$I = \frac{7.797}{267.62 \times 0.04} = 0.7284 A //$