OYEDEJI ALAMUTU OLADAPO
15/ENG04/050
ELECTRICAL/ELECTRONICS ENGR
EEE 552 ASSIGNMENT

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

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

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

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

or

$1.19 \times 10^4 \text{ cd/m}^2$

– $L = \frac{0.22}{\pi} \times \frac{85}{100}$

$= \frac{0.22}{3.142} \times \frac{85}{100}$

$= 59.52 \times 10^{-3} \text{ cd/m}^2$

b) – $\Phi = I \times \omega = 120 \times 4\pi$ lumen

(flux emitted by globe (30% is absorbed)

$120 \times 4 \times 3.142 \times 30\% = 144\pi = 452.45$ lumen

$\therefore$ flux being emitted by globe $= 120 \times 4 \times 3.142 - 144 \times 3.142$

$= 1508.16 - 452.45$

$= 1055.71$ lumen

Luminance $= \frac{\text{flux emitted}}{\text{Area}} = \frac{1055.71}{0.1521} = 6941 \text{ lm/m}^2$

– Candle Power $= \frac{\text{lumen}}{\omega} = \frac{1055.71}{12.566}$

$= 84 \text{ cd}$

c) $A = 75\times10^{-4}\ m^2$

$t = 2\times10^{-2}\ m$

Heat required $= mC\Delta\theta$

Density $= m/V$ where $m = 0.55\ g/cm^2 \times (75\times2)\ cm^3$

$= 82.5\ g$

$C = \frac{\varepsilon_0\varepsilon_r A}{t} = \frac{8.85\times10^{-12}\times6.5\times75\times10^{-4}}{2\times10^{-2}} = 21.57\times10^{-12}\ F$

$\omega = 2\pi f = 2\times\pi\times20\times10^6 = 125.664\times10^6\ rad/s$

PF $= \cos\phi = 0.04$

$\phi = 87.7$

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

Heat required $= MC\Delta\theta$

$= 82.5\times0.255\times(80-30)$

$= 1051.88\ Cal.$

Total heat required $= \frac{1051.88\times85}{100} = 894.098\ Cal.$

$1\ cal = 4.186\ (W\cdot S)\ J$

$894.098 = x$

Power input $= 894.098\times4.186 = 3742.7\ (W-S)$

$P = \frac{\text{energy}}{\text{time}} = \frac{3742.7}{8\times60} = 7.797W$

$P_2 = V^2\omega C\tan\delta$

$7.797 = V^2\times125.664\times10^6\times21.57\times10^{-12}\times\tan2.3$

$\frac{7.797}{1.08868\times10^{-4}} = V^2 \quad V = 267.62\ V_0$

$P = IV\cos\phi$

$I = \frac{7.797}{267.62\times0.04} = 0.7284\ A_0$