EEE 532 ASSIGNMENT
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15/ENG04/1009
Elect/Elect

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

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

Considering reflection factor

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

$L = \frac{4400}{\pi} \times \frac{88}{100} = 1.19 \times 10^{3}\ cd/m^2$

ii) $L = \frac{0.22}{\pi} \times \frac{88}{100} = 59.52 \times 10^{-3}\ cd/m^2$

b i Flux emitted by source

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

Flux emitted by globe (30% is absorbed)

$\frac{120 \times 4\pi \times 30}{100} = 144\pi$

$\therefore$ Flux emitted by globe = $480\pi - 144\pi$

$= 336\pi$ lumen

Luminence = $\frac{\text{flux emitted}}{\text{Area}} = \frac{336\pi}{\pi \times 0.22^2} = \frac{336}{0.22^2} =$

$= 6962$ lumen/m^2

ii.) Candela Power = $\frac{\text{Lumen}}{W} = \frac{336\pi}{4\pi} = 84\,cd$

c.) $A = 7.5\times10^{-4}\,m^2 = 75\,cm^2$

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

heat required: $mc\theta$

$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$

mass = density × volume

$m = 0.55\,g/cm^3 \times (75\times2)\,cm^3$

$= 82.5\,g$

$C = \frac{E_o F_r A}{t} = \frac{8.85\times10^{-12}\times6.5\times75\times10^{-4}}{2\times10^{-2}}$

$= 21.57\times10^{-12}\,F$

$\omega = 2\pi f$

$= 2\times\pi\times20\times10^6$

$= 125.68\times10^6\,rad/s$

Power factor = $\cos\phi = 0.04$

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

$= 87.7^\circ$

$\delta = 90 - \phi$

$= 90 - 87.7$

$= 2.3^\circ$

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

$= 1051.88\,cal$

Total heat required = $1051.88 \times \frac{88}{100} = 894.098$ Cal

1 cal = 4.186 (W.s)

894.098 = x

$x = 894.098 \times 4.186 = 3742.7$ (W-s) = power input

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

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

$V^2 = \frac{P_d}{w c \tan\delta}$

$V = \sqrt{\frac{P_d}{w c \tan\delta}}$

$V = \sqrt{\frac{7.797}{125.66 \times 10^6 \times 21.57 \times 10^{-12} \times \tan(2.3)}}$

$V = 267.62\ V$

$P = IV\cos\phi$

$I = \frac{P}{V\cos\phi} = \frac{7.797}{267.62 \times 0.84} = 0.728\ A$