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Mat No: 16/ENG04/070 ELECT/ELECT ENGR.
Course code: EEE552 [Electrical utilization]

ASSIGNMENT

(1.) $D = 1500m$

Schedule speed $= 36km/hr = 36 \times \frac{5}{18} = 10m/s$

$\beta = 3km/hr/s = 3 \times \frac{5}{18} = \frac{5}{6} m/s^2$

Schedule time of run $= \frac{1500}{10} = 150s$

Actual time of run $= 150 - 25 = 125s$

$\therefore V_a = \frac{1500}{125} = 12m/s$

$V_m = 1.25 \times 12 = 15m/s$

$$K = \frac{D}{V_m^2}\left(\frac{V_m}{V_a} - 1\right) = \frac{1500}{15^2}(1.25 - 1)$$

$$= \frac{5}{3}$$

$$K = \frac{1}{2}\left(\frac{1}{\alpha} + \frac{1}{\beta}\right) \text{ or } \frac{5}{3} = \frac{1}{2}\left(\frac{1}{\alpha} + \frac{6}{5}\right)$$

$\alpha = 0.47m/s^2 = 0.47 \times \frac{18}{5}$

$= 1.7km/h/s$

2

$V_a = 36 \text{ km/h} = 36 \times 5/18 = 10 \text{ m/s}$

$\alpha = 1.8 \text{ km/h/s} = 1.8 \times 5/18 = 0.5 \text{ m/s}^2$

$\beta = 3.6 \text{ km/h/s} = 3.6 \times 5/18 = 1.0 \text{ m/s}$

$t = D/V_a = 2000/10 = 200 \text{ s}$

$K = (\alpha + \beta)/2\alpha\beta = (0.5 + 1.0)/2 \times 0.5 \times 1$

$= 1.5$

$$V_m = \frac{t - \sqrt{t^2 - 4KD}}{2K}$$

$$= \frac{200 - \sqrt{200^2 - 4 \times 1.5 \times 2000}}{2 \times 1.5}$$

$= 11 \text{ m/s} = 11 \times 18/5$

$= 39.6 \text{ Km/h}$

(3)

If L is the side of the tank, then ~~total~~ Surface area of the tank $= 6L^2$

$\therefore 6L^2 = 6$ or $L = 6/6 = 1m^2$

Volume of the tank $= L^3 = 1m^3$

Volume of water to be heated daily $= 6 \times (1 \times 0.9)$

$= 5.4m^3$

Since $1m^3$ of water weighs 1000kg, mass of water to be heated daily $= 5.4 \times 1000 = 5400kg$

Heat required to raise the temperature of water $= 5400 \times 4200 (65 - 20) = 1020 mJ$

$= 1020 / 3.6 = 283.3 kwh$

Loading in kw $= \frac{324.1}{24} = 3.5kw$

Efficiency of the tank $= 283.3 \times 100/324.1$

$= 87.4\%$

(4)

Secondary Current $= \frac{600 \times 10^3}{20 \times 0.6} = 5 \times 10^4 A$

If this current is taken as the reference quantity, then Secondary voltage is

$V_2 = 20(0.6 + j0.8) = (12 + j16) v$

Secondary impedance $Z_2 = \frac{(12 + j16)}{(5 \times 10^4)}$

$= (2.4 + j3.2) \times 10^{-4} \Omega$

Now, If the secondary resistance is doubled while reactance remains constant, the impedance when hearth is half full becomes

$Z_2 = (4.8 + j3.2) \times 10^{-4} \Omega$

$\therefore$ Secondary Current $I_2 = \frac{20}{(48 \times j3.2) \times 10^{-4}}$

$= 3.466 \angle -33.7^\circ \times 10^4 A$

Now p.f $= \cos 33.7 = 0.832$

~~Hence, power factor~~

Hence, power absorbed $= 20 \times 3.466 \times 10^4 \times 0.832 \times 10^4$

$= 580 kw$

Scanned with CamScanner

(5)

(a) $E = \frac{300}{20^2}$ without Reflector

$= 0.75 \, lm/m^2$

(b) $\theta = \tan^{-1}(10/20) = \tan^{-1}(0.5)$

$= 26.6^\circ$

$\cos\theta = 0.89$, $x^2 = 10^2 + 20^2$

$= 500$

$\therefore E = \frac{300}{0.89 \times 500}$

$= 0.534 \, lm/m^2$

with Reflector

Luminious output of the lamp

$= 300 \times 4\pi$ lumen

flux directed by the reflector

$= 0.5 \times 1200\pi = 600\pi/m$

Illumination produced on the disc

$= \frac{600\pi}{100\pi} = 6 \, lm/m^2$

It is the same at every point on the disc