SALAMI ABDULHAFEEZ .T.
15/ENG04/054
EEE 552

QUESTION 1 SOLUTION

Converting km to m

$D = 1.5 \times 1000$

$D = 1500\,m$

Scheduled speed = $36 \times 5/18$ = ~~5/6 m/s²~~ 10 m/s

β = 3 km/h/s = $3 \times 5/18 = 5/6\ m/s^2$

Scheduled time of run = $1500/10 = 150\,s$;

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

$V_a = 1500/125 = 12\,m/s$; $V_m = 1.25 \times 12 = 15\,m/s$

$K = \frac{D}{V_m^2}\left[\frac{V_m}{V_a} - 1\right] = \frac{1500}{15^2}\left[1.25 - 1\right] = 5/3$

$K = 1/2\left[1/\alpha + 1/\beta\right]$ or $5/3 = 1/2\left[1/\alpha + 6/5\right]$

$\alpha = 0.47\,m/s^2 = 0.47 \times 18/5 = 1.7\,km/h/s$

QUESTION 2 SOLUTION

$V_a = 36\,km/h = 36 \times 5/18 = 10\,m/s$

$\alpha = 1.8\,km/h/s = 1.8 \times 5/18 = 0.5\,m/s^2$, $\beta = 3.6\,km/h/s = 3.6 \times 5/18 = 1.0\,m/s^2$

$C = D/V_a = 2000/10 = 2000$; $K = (\alpha + \beta)/2\alpha\beta = (0.5 + 1.0)/2 \times 0.5 \times 1 = 1.5$

$V_m = \frac{1 - \sqrt{\gamma^2 - 4KD}}{2K} = \frac{200 - \sqrt{200^2 - 4 \times 1.5 \times 2000}}{2 \times 1.5}$

$\Rightarrow 11\,m/s = 11 \times 18/5$

$= 39.6\,Km/h.$

Scanned with CamScanner

QUESTION 3 SOLUTION

~~[crossed out]~~

Total Surface of tank is $6t^2$

where $6t^2 = t$ $t = 1m^2$

Volume of tank = $t^3 = 1m^3$

Volume of water to be heated daily = $6 \times [1 \times 0.9] = 5.4 m^2$

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

Heat required to raise temp of water = $5400 \times 4200 [65 - 20]$

=> $1020MJ = 1020/3.6 = 283.3kWh$

Daily loss from tank Surface = $6.3 \times 6 \times (65-20) \times 24/1000$

=> $40.8 kWh$

Energy Supplied per day = $283.3 + 40.8 = 324.1 kWh$

Loading on kW = $324.1/24 = 3.5 kW$

Efficiency of tank = $283.3 \times 100/324.1 = 87.4\%$

QUESTION 4

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

If this current is taken as reference quantity then Sec Voltage is

$V_2 = 20 [0.6 + j0.8] = [12 + j16] V$

Secondary impedance: $Z_2 = \frac{[12 + j16]}{[5 \times 10^4]}$

$= [2.4 \times j3.2] \times 10^{-4}$ ohm

If Sec resistance is doubled while reactance remains constant, Impedance becomes.

$Z_2 = [4.8 + j3.2] \times 10^{-4}$ ohm.

Now, Sec Current $I_2 = \frac{20}{[4.8 \angle 33.2] \times 10^{4}}$

$\Rightarrow 3.466 \angle -33.7^\circ \times 10^{4} A.$

$P_f = \cos 33.7 = 0.832$

Power Absorbed becomes $= 20 \times 3.466 \times 10^{4} \times 0.832 \times 10^{4}$

$= 580\ kW$

QUESTION 5 SOLUTION

With reflector

Luminous output of lamp $= 300 \times 4\pi$ lumen

Flux directed by reflector $= 0.5 \times 1200\pi$

$\Rightarrow 600\pi\ lm$

Illumination produced on disc $= \frac{600\pi}{100\pi}$

$= 6\ lm/m^2$

∴ ~~Ef~~

Without reflector

(a) $E = \frac{300}{20^2}$

$\Rightarrow 0.75\ lm/m^2$

(b) $\theta = \tan^{-1}[10/20] = \tan^{-1}[0.5] = 26.6^\circ$

$\cos\theta = 0.89, \quad x^2 = 10^2 + 20^2 = 500$

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

$\Rightarrow 0.534\ lm/m^2$