EEE 552 ASSIGNMENT
Aturamu Adeola Emmanuel
15/ENG04/009
Elect/Elect

Question 1

$D = 1500m$

$Speed = 36Km/h = 36 \times \frac{5}{18} = 10m/s$

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

Scheduled Run time $= \frac{1500}{10} = 150s$

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

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

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

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

~~= 1.7 Km/h/s~~

Also

$K = \frac{1}{2}\left[\frac{1}{\alpha} + \frac{1}{\beta}\right]$

$\frac{5}{3} = \frac{1}{2}\left[\frac{1}{\alpha} + \frac{1}{\beta}\right]$

$\alpha = 0.47 m/s$

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

$= 1.7 Km/h/s$

Question 2

$V_a = 36\ Km/h = 36 \times \frac{5}{18} = 10 m/s$

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

$\beta = 3.6\ Km/h/s = 3.6 \times \frac{5}{18} = 1 m/s^2$

$t = \frac{D}{V_a}$

$D = 2000m$

$t = \frac{2000}{10} = 200s$

$K = \frac{(\alpha + \beta)}{2\alpha\beta} = \frac{(0.5 + 1)}{2 \times 0.5 \times 1} = 1.5$

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

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

$= 11 m/s$

$\therefore V_m = 11 \times \frac{18}{5} = 39.6 Km/h$

Question 3

If l is the side of the tank then the total surface area of the tank $= 6l^2$

$\therefore l = \frac{6}{6} = 1m^2$

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

Volume of water to be heated daily $= 6 \times (1 \times 0.9)$
$= 5.4 m^3$

Since $1m^3$ of water weighs 1000kg

The mass of water to be heated daily $= 5.4 \times 1000$
$= 5400 kg$

Heat required to raise temperature of water
$= 5400 \times 4200 (65-20)$
$= 1020 MJ = \frac{1020}{3.6}$
$= 283.3 kWh$

Daily loss from surface of the tank
$= 6.3 \times 6 \times (65-20) \times \frac{24}{1000}$
$= 40.8 kWh$

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

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

Efficiency of the tank $= \frac{283.3 \times 100}{324.1} = 87.4\%$

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 the Secondary voltage (V_2):

$V_2 = 20(0.6 + j0.8)$

$= (12 + j16)$ V

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

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

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

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

~~Secondary current $I_2 = 20/(4.8 + j3.2) \times 10^{-4}$~~

Secondary current $= \frac{20}{(4.8 + j3.2) \times 10^{-4}}$

$= \frac{20}{5.77\angle 33.7^\circ \times 10^{-4}}$

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

Power factor = $\cos 33.7^\circ = 0.832$

$\therefore$ Power absorbed = $20 \times 3.466 \times 10^4 \times 0.832 \times 10^{-3}$

$= 580$ KW

Question 5

(a) Without Reflector

$E = \frac{300}{20^2}$

$= 0.75 \ lm/m^2$

(b)

$\theta = \tan^{-1}\left(\frac{10}{20}\right) = 26.6°$

$\cos\theta = 0.89$

$x^2 = 10^2 + 20^2 = 500$

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

$= 0.534 \ lm/m^2$

With Reflector

Luminous output of lamp $= 300 \times 4 \times 3.142$

$= 3770.4$ lumen

flux directed by reflector $= 0.5 \times 1200 \times$ ~~3.142~~ 3.142

$= 1885.2$ lumen

Illumination produced on the disc $= \frac{1885.2}{314.1}$

$= 6 \ lm/m^2$

It is the same at every point on the disc