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15/ENG04 YO10

EEE 552 Assignment

$$\textcircled{1} \quad D = 1500 \text{m} \quad \text{schedule speed} = 36 \text{km/hr}$$

$$\text{Braking acceleration } \beta = 3 \times 5/18 = 5/6 \text{ m/s}^2$$

$$V = \frac{d}{t} \Rightarrow t = \frac{d}{v} = \frac{1500}{10} \frac{150}{10} = 150 \text{s}$$

$$\text{Actual time of run} = 150 - 25 = 125 \text{s}$$

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

$$V_{20\%} = 1.25 \times 12 = 15 \text{m/s}$$

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

$$\text{Recall } K = \frac{1}{2} \left( \frac{1}{\alpha} + \frac{1}{\beta} \right)$$

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

$$\alpha = 0.4 \text{m/s}^2 = 0.47 \times \frac{18}{5} = 1.7 \text{m/s}^2$$

$$\therefore \text{acceleration } \alpha = 1.7 \text{m/s}^2$$

$$\textcircled{2} \quad V_a = 36 \text{ hm}^3/\text{h} = 36 \times \frac{5}{18} = 10 \text{ m/s}$$

$$\alpha = 1.8 \text{ hm}^3/\text{h s} = 1.8 \times \frac{5}{18} = 0.5 \text{ m/s}^2$$

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

$$k = \frac{\alpha + \beta}{2\alpha\beta} = \frac{(0.5 + 1.0)}{2(0.5 \times 1)} = 1.5$$

$$V_m = t - \frac{\sqrt{t^2 - 4kD}}{24} = \frac{200 - \sqrt{200^2 - 4 \times 1.5 \times 2000}}{2 \times 1.5}$$

$$= 11 \text{ m/s} = 11 \times \frac{18}{5} = 39.6 \text{ hm}^3/\text{h}$$

$$3 \quad T.S.A \text{ of the tank} = 6L^2$$

$$\therefore 6L^2 = 6, L = \frac{6}{6} = 1 \text{ m}^2$$

$$\text{Vol of the tank} = 1^3 = 1 \text{ m}^3$$

$$\text{Vol of water to be heated daily} = 6 \times (1 \times 10^9) \\ = 5.4 \text{ m}^3$$

Since  $1 \text{ m}^3$  of water weighs 1000 kg

$$\text{mass of water} = 5.4 \times 1000 = 5400 \text{ kg}$$

$$\text{Heat required to raise the temp of water} = 5400 \times \\ 4200 \times (65 - 20) \\ = 1020 \text{ MJ}$$

$$\text{IF } 1 \text{ hm}^3 = 3.6 \text{ MJ}$$

$$\text{then } 1020 \text{ MJ} = 1020 / 3.6 = 283.3 \text{ hm}^3$$

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

$$\text{Energy supplied per day} = 283.3 + 40.8 = 324.1 \text{ kWh}$$

Loading in kWh =  $324.1 / 24$   
 $= 3.5 \text{ kWh}$

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

(4)

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

$$\text{Secondary voltage } V_2 = 20(0.6 + j0.8) = (12 + j16) \text{ V}$$

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

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

If resistance is doubled and reactance is constant  
 the impedance half-hull becomes

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

$$\text{New secondary Current } I_2 = \frac{20}{(4.8 + j3.2) \times 10^{-4}} \\ = 3.466 \angle -33.7^\circ \times 10^4 \text{ A}$$

$$\text{Now pf} = \cos 33.7 = 0.832$$

$$\text{Hence power absorbed} = 20 \times 3.466 \times 10^4 \times 0.832 \times 10^4 \\ = 580 \text{ kW}$$

5 without Reflector

(a)  $E = \frac{300}{20^2} = 0.75 \text{ lm/lm}^2$

(b)  $\theta = \tan^{-1}\left(\frac{10}{20}\right) = \tan^{-1}(0.5) = 26.6^\circ$

$\cos \theta = 0.89, r_1^2 = 10^2 + 20^2 = 500$

$\therefore E = \frac{300}{0.89 \times 500} = 0.534 \text{ lm/lm}^2$

with Reflector

Luminous output of the lamp =  $300 \times 4\pi \text{ lumen}$

Flux directed by the reflector =  $0.5 \times 1200\pi$   
 $= 600\pi \text{ lum}$

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

$= 6 \text{ lm/lm}^2$

It is the scene <sup>of</sup> every point on the disc.