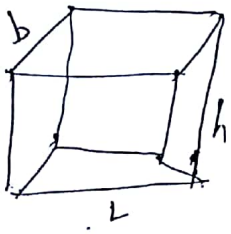
Solution Tut 2-3

Q.No-1 $h = 15\,ft$, $b = 20\,ft$, $L = 30\,ft$, side 3

$\alpha_{wall} = 0.03$; $\alpha_{carpet} = 0.20$; $\alpha_{ceiling} = 0.15$

$S_{wall} = 2h(l+b)$; $S_{carpet} = b \times l$; $S_{ceiling} = b \times l$

$= 1500\,ft^2$; $= 600\,ft^2$; $= 600\,ft^2$



$$T = \frac{0.05 \times V}{\Sigma \alpha_i S_i} \Rightarrow T = \frac{0.05 \times [30 \times 20 \times 15]}{0.03 \times 1500 + 0.02 \times 600 + 0.15 \times 60}$$

$$T = \frac{450}{255} = 1.7647 \text{ sec}$$

$T = 1.7647$ sec

Q.No-2 $h = 15\,ft$, $b = 20\,ft$, $l = 30\,ft$, $\alpha_{avg} = 0.20$

$V = b \times b \times l = 900\,ft^3$

$S = 2(lb + bh + lh) = 2(600 + 300 + 450) = 2700\,ft^2$

$$T_1 = \frac{0.05 \times 9000}{0.02 \times 2700} = 8.33 \text{ sec} \quad (1)$$

$$T_2 = \frac{8.33}{2} = 4.16 \Rightarrow T_2 = \frac{0.05 \times 9000}{\bar{\alpha} \times 2700} \quad (2)$$

$$\bar{\alpha} = \frac{0.05 \times 9000}{4.16 \times 2700} = 0.40$$

Q.No-3 $V = 7500\,m^3$; $T_0 = 1.5$ sec , A = absorbing power

$$\Rightarrow T = \frac{0.161 \times V}{A} \Rightarrow A = \frac{0.161 \times 7500}{1.5} = 805 \left(\frac{ft^2}{owu}\right)$$

Q.No-4 $V = (20 \times 40 \times 60)\,ft^3 = 80{,}000$

$\bar{\alpha} = 0.03$, Seats $= 400$, $\alpha_{seats} = 0.15$, $\alpha_{person} = 4.7\,ft^2$ owu

Surface area $= 2(400 + 800 + 2000) = 13600\,ft^2$

(1) When Audi is empty $\Rightarrow T_1 = \frac{0.05 \times 80{,}000}{0.03 \times 13600 + 400 \times 0.15} = 8.55$ sec

(2) When Audi is full $\Rightarrow T_2 = \frac{0.05 \times 80{,}000}{0.03 \times 13600 + 400 \times (4.7)} = 1.75$ sec

Q.4: Given:- $\alpha_m = 0.2$; $T_3 = 2$ Sec; S_m ??; $T_1 = 8.55$ sec (2)

$$\Rightarrow S_m = \frac{0.05 \times 80{,}000}{0.2}\left(\frac{1}{T_3} - \frac{1}{T_1}\right) = \underline{\underline{7660\ ft^2}}$$

Q.N.-5

(i) $T_{empty} = 1.5$ sec; $T_{curtain} = 1.3$ sec; $V = (10 \times 8 \times 6)m^3 = 480\ m^3$

$S_{area} = 376\ m^2$

$$T_{empty} = \frac{0.161 \times 480}{\bar{\alpha} \times S} \Rightarrow \bar{\alpha}_{empty} = \frac{0.161 \times 480}{1.5 \times 376} = \underline{\underline{0.137}}$$

(ii) $$\boxed{T_{curtain} = \frac{0.161 \times 480}{(0.137 \times 376) + \alpha_{curtain} \times 40}}$$

[∵ both side area of curtain $2 \times 20 = 40\ m^2$]

~~$\Rightarrow 1.3 = \frac{0.161 \times 480}{(0.137 \times 376)}$~~

$$1.3 = \frac{77.28}{51.52 + 40\alpha_{curtain}} \Rightarrow 51.52 + 40\alpha_{curtain} = 59.45$$

$$\Rightarrow \boxed{\alpha_{curtain} = 0.198}$$

(iii) $T = 1.1$ sec $\Rightarrow 1.1 = \frac{0.161 \times 480}{0.137(376 - S_2) + 0.198 \times S_2}$

$$\Rightarrow \boxed{S_2 = 307.25\ m^2}$$

Q.N-6:- $V = (10 \times 20 \times 30)ft^3 = 6000\ ft^3$; $\bar{\alpha} = 0.3$; $S = 2200\ ft^2$

$$T_{Sabin} = \frac{0.05 \times 6000}{0.3 \times 2200} \Rightarrow \boxed{T_{Sabin} = 0.455\ \text{sec}}$$

$$T_{Eyring} = \frac{0.05 \times 6000}{-2200 \ln(1 - 0.3)} \Rightarrow \boxed{T_{Eyring} = 0.382\ \text{sec}}$$

Comment:- Sabin formula give higher value of reverberation time than Teying. Almost 18% higher value of T.

Q.N-7:- $V = (10 \times 20 \times 30)ft^3 = 6000\ ft^3$; $\bar{\alpha} = ??$; $S_{avg} = S_{curtain} + S_{room} = 2232\ ft^2$

$T_1 = 1$ S; $T_2 = 1.5$ S; $P_1 = 50$ W; $P_2 = 80$ W; $V = 1126\ ft/s$

$$\bar{\alpha} = \frac{4 \times V \times 2.3(\log_{10} P_1 - \log_{10} P_2)}{S_{avg} \times V(T_1 - T_2)} = \frac{4 \times 6000(\log_{10} 50 - \log_{10} 80)}{2232 \times 1126(1 - 1.5)}$$

$$\boxed{\bar{\alpha} = 0.009}$$