Assignment-3

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Q.1) A lecture hall with a volume of 60000 cu.ft is found to have a reverberation time of 1.6 sec. What is total absorbing power of the entire surface in the hall? If the area of the second absorbing surface is 9000 sq.ft Calculate average absorption coefficient.

=> Soln,

Vol. of lecture hall = 60000 cu = 1699.01 m^3
reverberation (T) = 1.6 sec

we have

$$T = \frac{0.158V}{\alpha S}$$

$$\alpha S = \frac{0.158V}{T}$$

$$= \frac{0.158 \times 1699.01}{1.6}$$

$$= 167.77$$

Here

the absorbing power is 167.77
Area of absorbing surface(S) = 9000 sq ft
$= 836.12 m^2$

now

$$\alpha \times 836.12 = 167.77$$

$$\alpha = \frac{167.77}{836.12}$$

$$\alpha = 0.20$$

the average absorption coefficient = 0.2.

Q(2) The vol. of room is $960 m^3$. The wall area of the room is $160 m^2$. ceilling area $96 m^2$ & floor area $90 m^2$. The average sound absorption coefficient (i) for wall is 0.03 (ii) for ceilling is 0.80 & (iii) for the floor is 0.06. Calculate the average sound absaption coefficient & reverberation time.

=> Soln,

The average sound absorption coefficient

$$\alpha = \frac{\alpha_1 S_1 + \alpha_2 S_2 + \alpha_3 S_3}{S_1 + S_2 + S_3}$$

$$= \frac{0.03 \times 160 + 0.8 \times 96 + 0.06 \times 90}{160 + 96 + 90}$$

$$= 0.2514$$

And total area

$$S = 160 + 96 + 90 = 346.$$

Now total absorption of the room

$$\alpha S = 0.2514 \times 346 = 86.98 \text{ sabin}$$

Reverberation time

$$T = \frac{0.158V}{\alpha_s}$$

$$= \frac{0.158 \times 960}{86.98}$$

$$= 1.744 \text{ sec}$$

Q5) Calculate the reverberation time of small hall of 1500 m^2 having seating capacity of 120 people when i) The hall is empty & ii) with full capacity of the audience for the following data.

Surface	Area	Coeff. of absorption
Plastered wall	1120 m^2	0.03
Wooden flower	130 m^2	0.06
Plastered ceiling	170 m^2	0.04
Wooden doors	20 m^2	0.06
Cushioned chairs	120	0.5
Audience	120	0.44

=> Soln. wooden flower = $130 \times 0.06 = 7.8$

absorption by plastered wall = $1120 \times 0.03 = 33.6$

plastered ceiling = $170 \times 0.04 = 6.80$

wooden door = $20 \times 0.06 = 1.2$

cushioned chair = $120 \times 0.5 = 60$

Total absorption (α_s) = 79.16

a) when the hall is empty

$$T = \frac{0.158V}{\alpha S_1} = \frac{0.158 \times 1500}{79.16}$$

$$= 2.99 \text{ sec}$$

b) When n the hall is filled to full capacity. absorption due to 120 people $= 120 \times 0.44$

$$= 52.8$$

total absorption$(\alpha S_2) = 79.16 + 52.8 = 131.96$

$$T = \frac{0.158V}{\alpha S_2} = \frac{0.158 \times 1500}{131.96}$$

$$= 1.795 \text{ sec}$$

Q.3) A lecture hall of vol. $12 \times 10^4 \text{ m}^3$ has a total absorption of 13200 m^2 of open window unit. Entry of student in the hall raise the absorption by another 13200 m^2 of open window unit. Find the change in reverberation time.

Soln

$$T = \frac{0.158V}{\alpha S}$$

First case

$$T_1 = \frac{0.158 \times 12 \times 10^4}{13200}$$

$$= 1.43 \text{ sec}$$

Second case:

$V = 12 \times 10^4 \, m^3$

Absorption case $= [13200 + 13200] \, m^2$

$= 26400 \, m^2$

$$T_2 = \frac{0.158 \times 12 \times 10^4}{26400}$$

$= 0.71 sec$

~~which~~ people fill the hall, time of reverberation change by $= (1.43 - 0.71)$

$= 0.72 sec.$ #