

ME513

Session 44

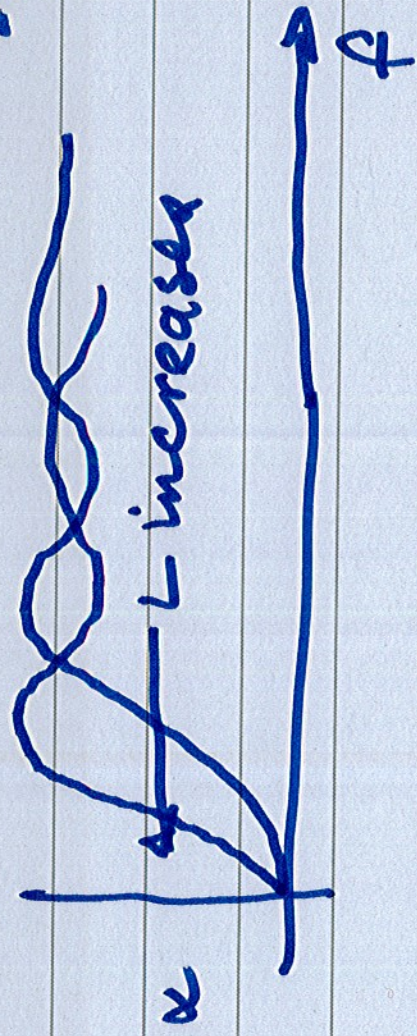
12/6/19

Similar to 2015 Exam

Room Acoustics

Absorbing Materials

- Porous materials

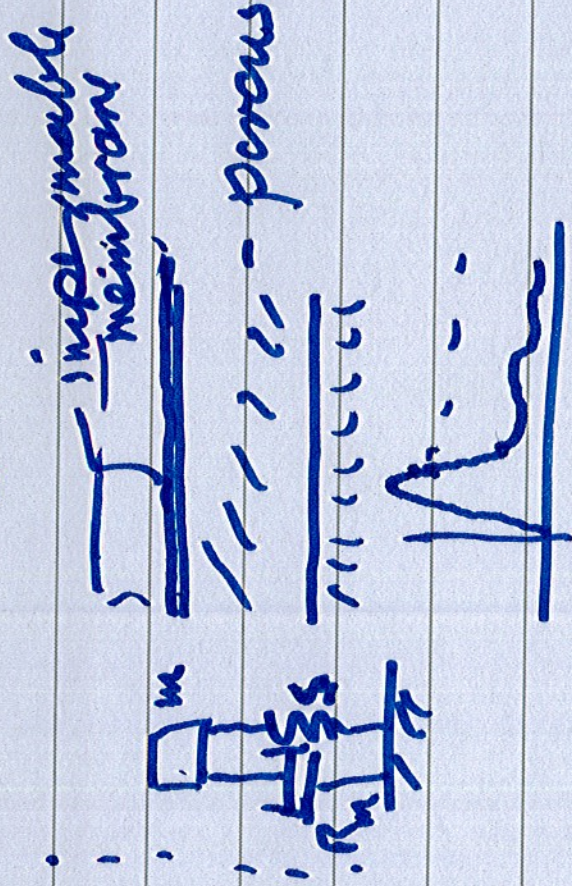


$$L > \lambda/10$$

1" of good glass fiber (25 max)
absorbs well at 1 kHz & above

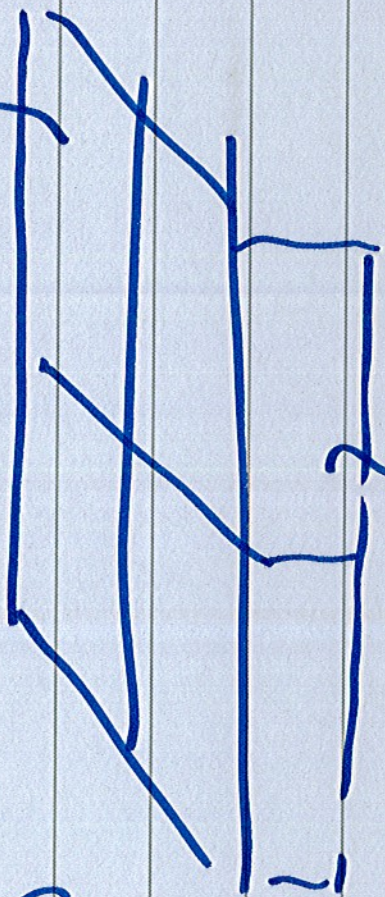
$\alpha = 0.5$ at 1 kHz

2" \rightarrow 500 Hz and above

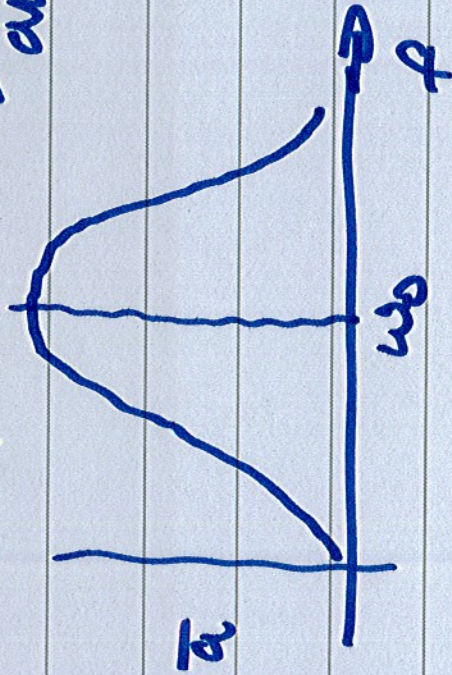
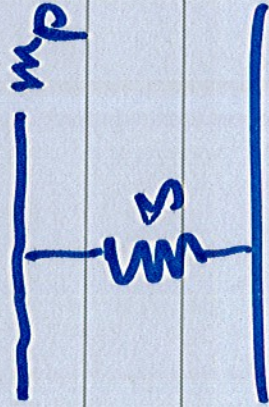


resonant
panels

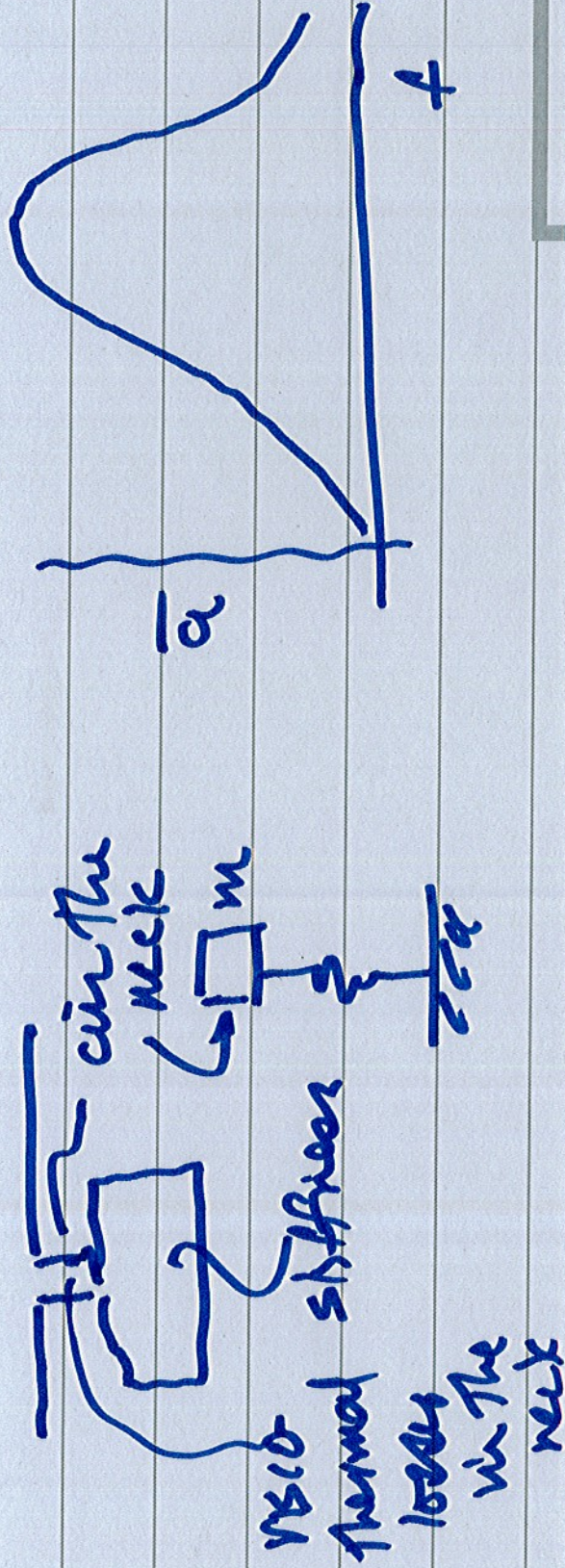
(ii)



segmented air space
porous layers in the
air space

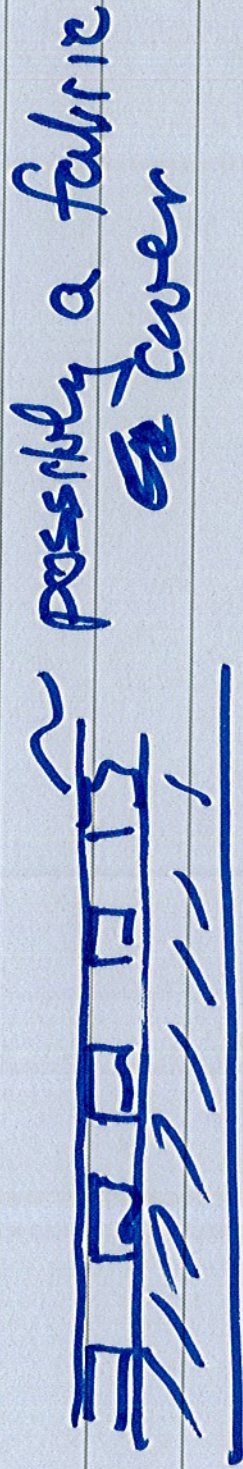


(iii) Cavity Absorbers (Helmholtz resonator)



- average of differently sized resonators to cover a range of freqs

perforated panels - if the perforation
is sufficient $\geq 30\%$ open area
- protect porous layer



- often used at the rear of concert
halls.

microperforated
panels

- panels - 0.1 mm diameter holes
10% open area ----- mpp

7.1.11

(iv) People & Furniture

- 1 person 1 m² of absorption
at 1 kHz

- chairs absorb sound

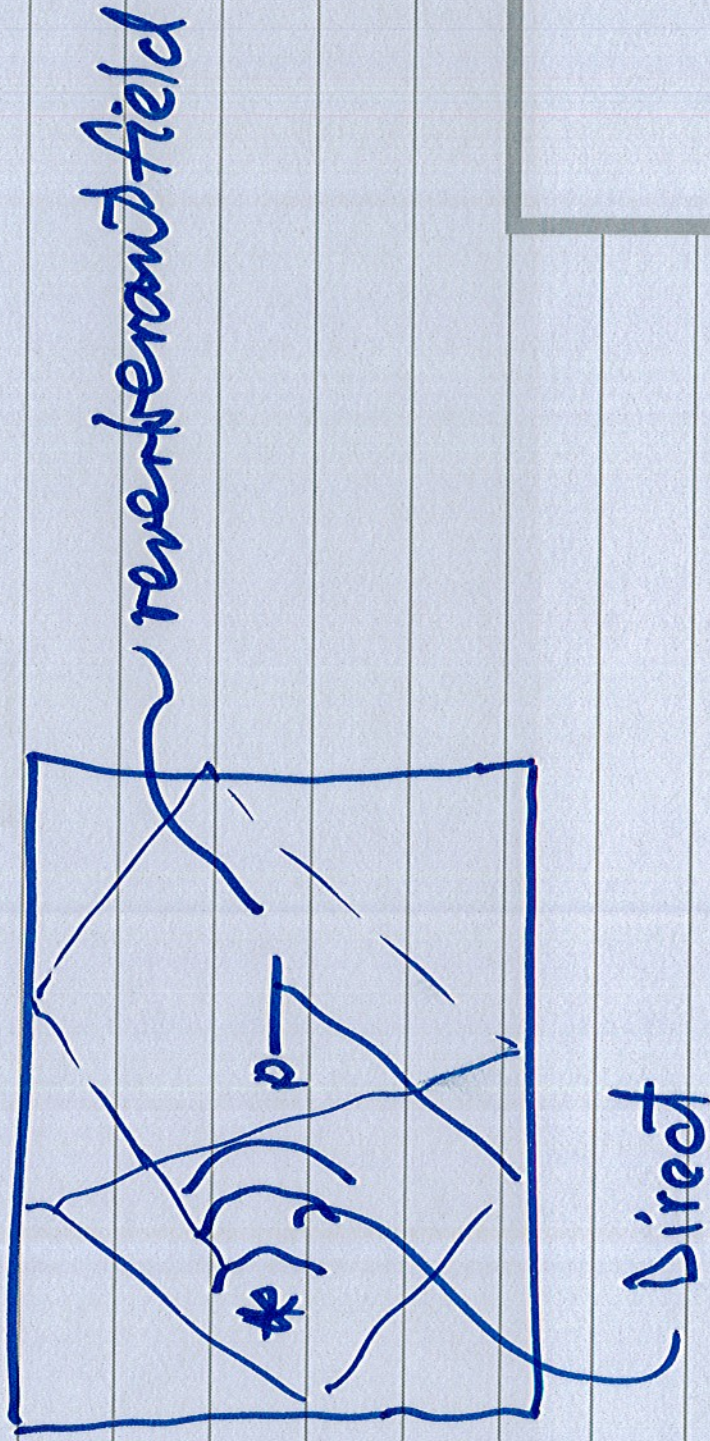
- machines also absorb sound

$$A = \sum_i s_i \bar{\alpha}_i + \sum_i A_i$$

↑
surface
treatment

absorption
areas for
individual
elements

6.7 Direct & Reverberant Sound Fields



total = sum of direct component
& reverberant component

Direct MSP - omnidirectional monopole

$$P_{d,rms}^2 = \frac{\rho c \pi I_s^2}{4\pi r^2}$$

The sound power of the source

Reverberant MSP

$$P_{rms}^2 = \rho c \pi I_s \frac{4}{A}$$

$$(P_{rms}^2)_{total} = P_0 c^2 \pi \left(\frac{1}{4\pi r^2} + \frac{q}{A} \right)$$

- assuming incoherent addition of the direct & reverberant fields

direct reverberant

r-distance from the source to the receiver

Ratio of the reverberant to direct
msp's

$$\frac{16\pi r^2}{A}$$

direct &
reverberant
levels are
The same

critical radius r_c when

$$\frac{16\pi r_c^2}{A} = 1$$

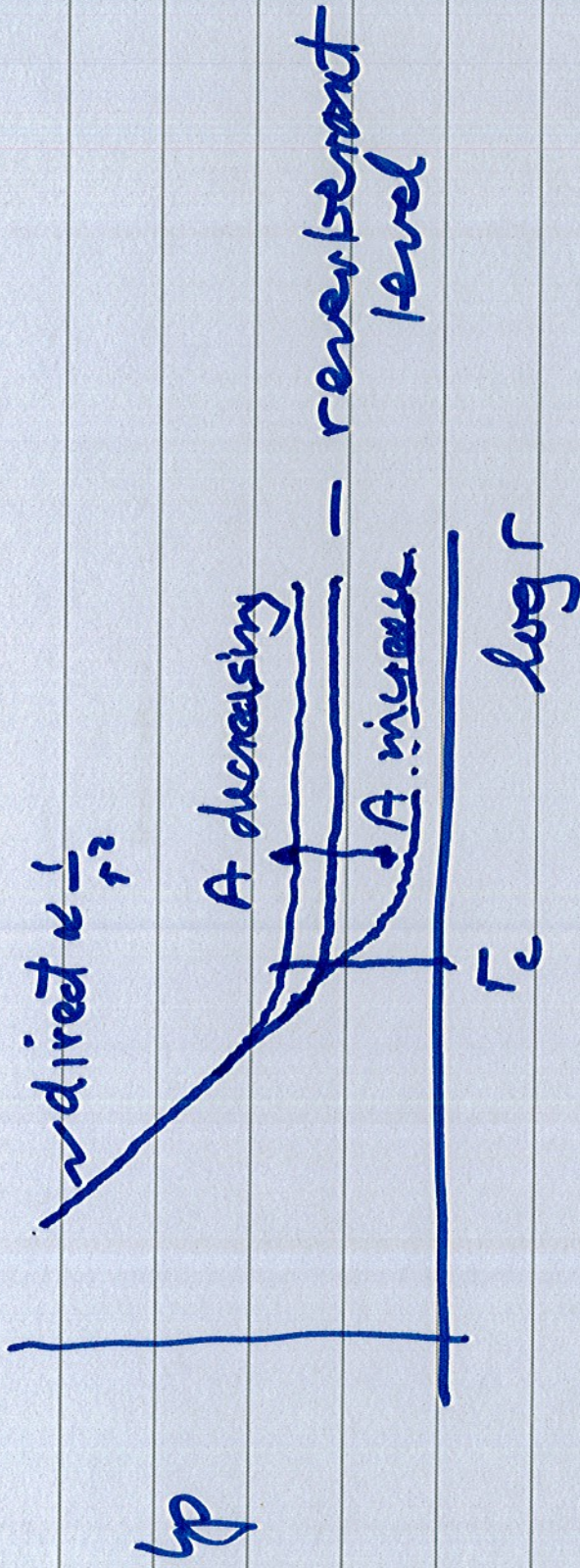
$$r_c^2 = \frac{A}{16\pi}$$

r_c - mark \Leftrightarrow The transition
from the direct to the reverb
field

- if the direct fields dominates at
some ~~to~~ location - no benefit
from adding absorption to the
walls

- only where the reverb field
dominates is there a
benefit

source $\rightarrow r$



- if in reverb field - adding
also helps

- if in direct field

- barriers
or enclosures