Assignment_10

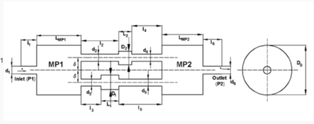
The due date for submitting this assignment has passed.

Due on 2021-03-31, 23:59 IST.

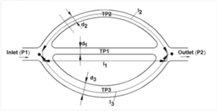
As per our records you have not submitted this assignment.

1) Which of the following muffler configurations support multi-wave propagation, i.e., non-unique wave propagation paths? *1 point*

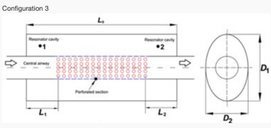
Configuration 1



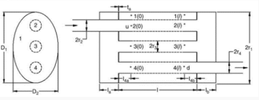
Configuration 2



Configuration 3



Configuration 4

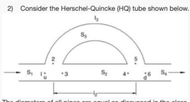


- 1, 2 and 4
- all of them
- only 1 and 2
- only 2 and 4

No, the answer is incorrect.
Score: 0

Accepted Answers:
1, 2 and 4

2) Consider the Herschel-Quincke (HQ) tube shown below. *1 point*



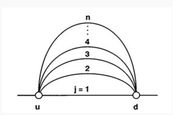
The diameters of all pipes are equal as discussed in the class, whilst the lengths $l_1 = 500mm$ and $l_2 = 785.4mm$. Consider sound speed $c_0 = 343m/s$. The first and second attenuation peaks occurs at frequencies given by

- 266.8 Hz and 600 Hz
- 533.7 Hz, 1802.7 Hz
- 266.8 Hz, 800 Hz
- attenuation peak at 0 Hz, 533.7 Hz

No, the answer is incorrect.
Score: 0

Accepted Answers:
266.8 Hz and 600 Hz

3) The junction laws for the n-duct, modified HQ tube configuration shown by the schematic below are given by *1 point*



- Equality of acoustic pressure as well as continuity of acoustic mass velocities at upstream u and downstream d points
- Only the equality of acoustic pressure at upstream and downstream
- Only the continuity of acoustic mass velocities at upstream u and downstream d points

No, the answer is incorrect.
Score: 0

Accepted Answers:
Equality of acoustic pressure as well as continuity of acoustic mass velocities at upstream u and downstream d points

4) For the same configuration shown in Q.3 where ducts have equal cross-sectional areas, the expression for resonance frequencies are given by *1 point*

- $\frac{1}{\sin k_0 l_1} + \frac{1}{\sin k_0 l_2} + \ldots + \frac{1}{\sin k_0 l_n} = 0$
- $\frac{1}{\cos k_0 l_1} + \frac{1}{\cos k_0 l_2} + \ldots + \frac{1}{\cos k_0 l_n} = 0$
- $\sin k_0 l_1 + \sin k_0 l_2 + \ldots + \sin k_0 l_n = 0$
- $\cos k_0 l_1 + \cos k_0 l_2 + \ldots + \cos k_0 l_n = 0$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{1}{\sin k_0 l_1} + \frac{1}{\sin k_0 l_2} + \ldots + \frac{1}{\sin k_0 l_n} = 0$

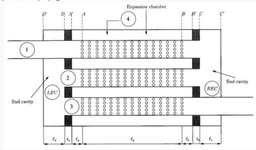
5) The impedance [Z] matrix for a 3-port muffler element is given by *1 point*

- $\begin{Bmatrix} p_1 \\ p_2 \\ p_3 \end{Bmatrix} = \begin{bmatrix} Z_{11} & Z_{12} & Z_{13} \\ Z_{21} & Z_{22} & Z_{23} \\ Z_{31} & Z_{32} & Z_{33} \end{bmatrix} \begin{Bmatrix} v_1 \\ v_2 \\ v_3 \end{Bmatrix},$
- $\begin{Bmatrix} v_1 \\ v_2 \\ v_3 \end{Bmatrix} = \begin{bmatrix} Z_{11} & Z_{12} & Z_{13} \\ Z_{21} & Z_{22} & Z_{23} \\ Z_{31} & Z_{32} & Z_{33} \end{bmatrix} \begin{Bmatrix} p_1 \\ p_2 \\ p_3 \end{Bmatrix},$
- $\begin{Bmatrix} p_1 \\ p_2 \\ p_3 \end{Bmatrix} = \begin{bmatrix} Z_{11} & Z_{12} & Z_{13} \\ Z_{21} & Z_{22} & Z_{23} \\ Z_{31} & Z_{32} & Z_{33} \end{bmatrix} \begin{Bmatrix} v_1 \\ v_2 \\ v_3 \end{Bmatrix},$
- $\begin{Bmatrix} v_1 \\ p_2 \\ p_3 \end{Bmatrix} = \begin{bmatrix} Z_{11} & Z_{12} & Z_{13} \\ Z_{21} & Z_{22} & Z_{23} \\ Z_{31} & Z_{32} & Z_{33} \end{bmatrix} \begin{Bmatrix} p_1 \\ v_2 \\ v_3 \end{Bmatrix},$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\begin{Bmatrix} p_1 \\ p_2 \\ p_3 \end{Bmatrix} = \begin{bmatrix} Z_{11} & Z_{12} & Z_{13} \\ Z_{21} & Z_{22} & Z_{23} \\ Z_{31} & Z_{32} & Z_{33} \end{bmatrix} \begin{Bmatrix} v_1 \\ v_2 \\ v_3 \end{Bmatrix},$

6) Consider the three-pass perforated duct muffler configuration with ducts flush-mounted with the end-chambers as shown below. Only axial plane wave propagation is considered. *1 point*



The following statement(s) are true

- For high porosities, The middle or central chamber containing perforated ducts behaves like an expansion chamber which contributes domes and troughs in the attenuation spectrum
- For high porosities, The end-chamber volumes acts as Helmholtz resonators that contribute an attenuation peak in the low-frequency range
- The pass-tube in the end-chambers will not have any influence on the low-frequency attenuation peaks
- At low-porosity, the communication between the middle chamber and end-chambers is inhibited, causing a reduction in low-frequency resonance and deviation from expansion chamber behaviour

No, the answer is incorrect.
Score: 0

Accepted Answers:
For high porosities, The middle or central chamber containing perforated ducts behaves like an expansion chamber which contributes domes and troughs in the attenuation spectrum
For high porosities, The end-chamber volumes acts as Helmholtz resonators that contribute an attenuation peak in the low-frequency range
At low-porosity, the communication between the middle chamber and end-chambers is inhibited, causing a reduction in low-frequency resonance and deviation from expansion chamber behaviour

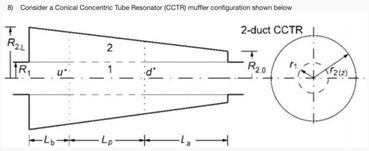
7) Considering a stationary medium, and for the following physical dimensions and porosity of the three-pass perforated duct muffler shown in Fig. 6: *1 point*
$l_p = 274mm, l_a = l_b = 27.9mm, l_c = 150mm, l_d = 102mm, t_a = t_b = 12.7mm, d1 = d2 = d3 = 48.9mm$, D4 = 165.1 mm, hole diameter $d_h = 2.34mm, t = 0.8mm, c0 = 343.7m/s$, the low-frequency attenuation peak (contributed by the end-chambers) approximately occurs at

- 250 Hz
- 200 Hz
- 310 Hz
- 400 Hz

No, the answer is incorrect.
Score: 0

Accepted Answers:
250 Hz

8) Consider a Conical Concentric Tube Resonator (CCTR) muffler configuration shown below *1 point*



A stationary medium ($c' = 0$, needs to be considered with the following dimensions, R1 = 25 mm, R2,0 = 75 mm, R2,L = 50 mm, hole diameter d* = 3 mm, inner pipe thickness t = 1 mm, La + Lp + Lb = 400 mm. Sound speed c0 = 343.14 m/s and porosity $\sigma = 30\%$.

Assuming only planar propagation, the extension lengths at the inlet (La) and outlet (Lb) extensions of the CCTR muffler configuration to obtain double-tuning is given by

- La = 205 mm, Lb = 85 mm
- La = 195 mm, Lb = 85 mm
- La = 195 mm, Lb = 115 mm
- La = 200 mm, Lb = 100 mm

No, the answer is incorrect.
Score: 0

Accepted Answers:
La = 205 mm, Lb = 85 mm