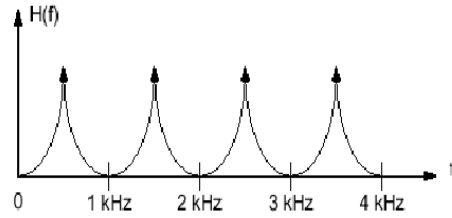


**Digital Speech Processing**  
**Week 2: Assignment Solution -2**

1. Length of a vocal tract is  $17.5\text{cm}$  and it model using single lossless acoustic tube. Determine the first two formant frequency and bandwidth for a voice sound. Where the speed of sound  $c=350\text{m/s}$ .
  - A.  $F_1=600\text{Hz}$ ,  $BW_1=25\text{Hz}$  and  $F_2= 1200\text{ Hz}$  , $Bw_2=13\text{ Hz}$
  - B.  $F_1=500\text{Hz}$ ,  $BW_1=0\text{Hz}$  and  $F_2= 1500\text{ Hz}$  , $Bw_2=0\text{ Hz}$**
  - C.  $F_1=700\text{Hz}$ ,  $BW_1=20\text{Hz}$  and  $F_2= 1400\text{ Hz}$  , $Bw_2=0\text{Hz}$
  - D.  $F_1=500\text{Hz}$ ,  $BW_1=15\text{Hz}$  and  $F_2= 1500\text{ Hz}$  , $Bw_2=10\text{ Hz}$
  
2. To produce a voiced speech signal of bandwidth  $5\text{ KHz}$  how many section of lossless tubes are required? Where length of the tube is  $17.5\text{cm}$  and  $c=35000\text{cm/s}$ .
  - A. 12
  - B. 8
  - C. 16
  - D. 10**
  
3. Length of a uniform tube is  $17\text{ cm}$  and the tube is closed at one end find out the value of the pressure wave in open end.
  - A.  $5\text{ Pa}$
  - B.  $2\text{ Pa}$
  - C. 0**
  - D.  $17\text{ Pa}$
  
4. If cross section area of a uniform tube is  $A$ , and average atmospheric density is  $\rho$  what will be value of acoustic inductance? Where  $c$  is the velocity of sound
  - A.  $A/\rho$**
  - B.  $A/\rho c^2$
  - C.  $\rho/A$
  - D.  $\rho c^2/A$
  
5. The frequency response of a uniform tube is as given in the following equation (1). The length of the tube  $l=17.5\text{ cm}$  and speed of sound  $c=350\text{m/s}$ . Which one will be the volume velocity vs. Frequency curve for first 4 roots?

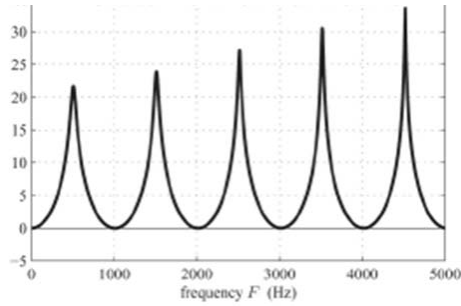
$$\frac{U(l, \Omega)}{U_g(\Omega)} = V_a(\Omega) = \frac{1}{\cos(\Omega l / c)} \quad \dots(1)$$

Volume velocity



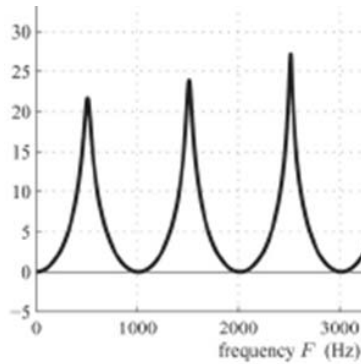
A.

Volume velocity



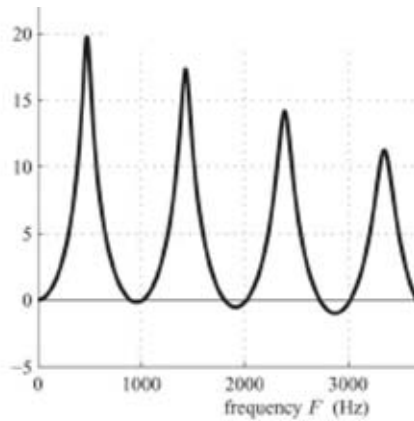
B.

Volume velocity



C.

Volume velocity



D.

6. Time varying glottal resistance and inductance-both functions of glottal opening  $AG(t)$ . If the glottis is completely closed what will be the value of glottal impedance and volume velocity?

A.  $\infty$

B. 0

C.  $120 \Omega$

D. None of those

[ Note: Please ignore volume velocity]

7. Suppose an electric fan produces a noise intensity of 40 dB. How many times more intense is the sound of a conversation if it produces an intensity of 60 dB?

A. 150

**B. 100**

C. 20

D. 30

8. Which of the following pair of tones is perceived as louder tone?

a) 25dB level at 300Hz and 25 db at 800 Hz (b) 5dB level at 3 KHz and 5dB level at 1 KHz.

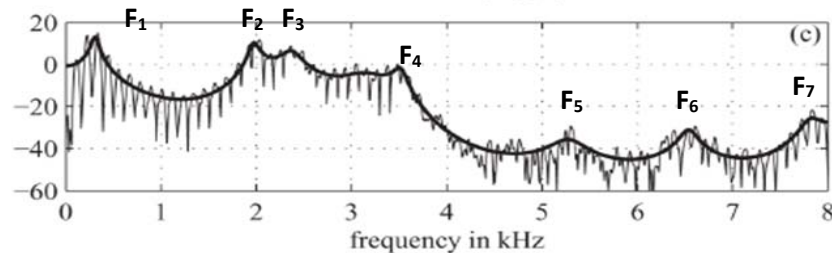
A. 5dB level at 1 KHz, 25 db at 800 Hz

B. 25dB level at 300Hz and 25 db at 800 Hz

C. 5dB level at 3 KHz, 25dB level at 300Hz

**D. 5dB level at 3 KHz and 5dB level at 1 KHz**

9. The frequency response of a uniform tube is as given as Figure-2. How many complex conjugate poles will be in the tube transfer function?



A. 16 complex pole

**B. 7 complex conjugate pole**

C. 15 of complex conjugate pole

D. 12 pair of complex conjugate pole

10. Reflection coefficient  $r_k$  for the junction of two lossless acoustic tubes of area  $A_k$  and  $A_{k+1}$  can be written as equation (1).

$$r_k = \frac{\frac{A_{k+1}}{A_k} - 1}{\frac{A_{k+1}}{A_k} + 1} \quad \dots(1)$$

What will be the value of  $r_k$ ?

A.  $-0.5 \leq r_k \leq 1$

B.  $-0.5 \leq r_k \leq 0.5$

**C.**  $-1 \leq r_k \leq 1$

D.  $0 \leq r_k \leq 1$