Waves mind map

Wave Equation →

- **Mechanical Waves:**
  - ↔ ∿→ Longitudinal Waves
  - ↕ ∿→ Transverse Waves
- **Wave function and eq.ⁿ →**

Wave function: $y = f(x \pm vt)$

Wave equation of a wave travelling +ve x direction →

$$y = A\sin(\omega t - Kx)$$

Transverse Wave →

- **Velocity of a Wave on a string:**

$$v = \sqrt{\frac{T}{\mu}}$$ T = Tension in string. μ = mass/length.

- **Power:** $P_{av} = \frac{1}{2}\mu\omega^2 A^2 v$

Intensity: $I_{av} = \frac{1}{2}\rho\omega^2 A^2 v$

→ phase difference = $\frac{2\pi}{\lambda} \times$ path difference.

Sound →

- **Speed of Sound:** $v = \sqrt{\frac{B}{\rho}}$ → Bulk modulus, → Density of med.

→ Acc.ⁿ to Newton: $v = \sqrt{\frac{P}{\rho}}$ Laplace Correction: $v = \sqrt{\frac{\gamma P}{\rho}}$

- **Loudness of Sound:**

$$L = 10\log_{10}\left[\frac{I}{I_0}\right]$$ I → intensity of sound, I_0 → Threshold of hearing $= 10^{-12}\ \frac{W}{m^2}$

Doppler's Effects →

- **Soure moving, Observer Stationary:**

$f = f_0\left[1 - \frac{v_s}{v}\right]$ O → $v_0 = 0$ S → $v_s \neq 0$

$f = f_0\left[1 + \frac{v_s}{v}\right]$ O → $v_0 = 0$ ← S $v_s \neq 0$

- **Observer moving, Source stationary:**

$f = f_0\left[1 + \frac{v_0}{v}\right]$ O → $v_0 \neq 0$ S → $v_s = 0$

$f = f_0\left[1 - \frac{v_0}{v}\right]$ ← O $v_0 \neq 0$ S → $v_s = 0$

- **Both Source and Observer moving:**

$f = f_0\left[\frac{v + v_0}{v - v_s}\right]$ → v_0 ← v_s

$f = f_0\left[\frac{v - v_0}{v + v_s}\right]$ ← v_0 → v_s

Standing Waves: →

- **Superposition of Waves:**

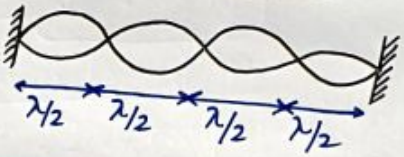
$$y = A\sin(\omega t + \phi)$$

→ If $\phi = 2n\pi$ → Constructive interference.

→ If $\phi = (2n-1)\pi$ → Destructive interference.

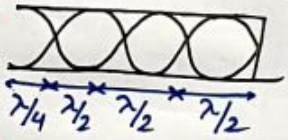
- **On a stretched string:**

$\lambda = \frac{2L}{n} \Rightarrow f = \frac{nv}{2L}$ n = nth harmonic = 1, 2, 3....



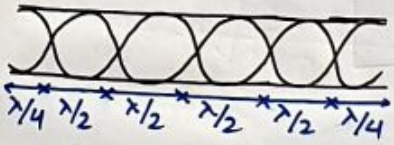
- **Closed Organ pipe:**

$\lambda = \frac{4L}{(2n+1)} \Rightarrow f = \frac{(2n+1)v}{4L}$ n = nᵗʰ overtone = 0, 1, 2, 3,....



- **Open Organ pipe:**

$\lambda = \frac{2L}{n} \Rightarrow f = \frac{nv}{2L}$ n = nᵗʰ harmonic = 1, 2, 3,...



- **Beats:**

Beat frequency = $f_1 - f_2$

NEET SLAYER