Sem-2/MJC(T)/Unit③ Date: 04-02-2025

Sub-Physics / By - Dr. Vinay K Singh

Topic: Beats —

When two waves of nearly same frequency travel along same straight in the same direction and the velocity of propagation is also the same then the such a phenomenon is called beats.

Combination of beats: The displacement of a particle having same frequency is given by -

$$y = a \sin 2\pi n t$$

where t = time
n = frequency of wave
a = amplitude of the vibration

Let us consider two waves motion of nearly same frequencies having values n_2 & n_1 then the displacement of a particle is given by,

$$y_1 = a \sin 2\pi n t \quad \text{—— ①}$$

and, $y_2 = a \sin 2\pi n_1 t$ —— ②

when the two waves superimpose then the resultant displacement Y is given by,

$$Y = y_1 + y_2 = a \sin 2\pi n t + a \sin 2\pi n_1 t$$

$$= 2a \cos 2\pi \left(\frac{n - n_1}{2}\right) t \sin 2\pi \left(\frac{n + n_1}{2}\right) t$$

$$\therefore Y = A \sin 2\pi \left(\frac{n + n_1}{2}\right) \quad \text{—— ③}$$

This equation denotes a periodic vibration of amplitude $A = 2a \cos 2\pi \left(\frac{n - n_1}{2}\right) t$, and frequency $\frac{n + n_1}{2}$.

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