Superposition of two Harmonic Waves

Principle of Superposition of Waves :-

The Superposition of Waves or Superposition of Simple Harmonic Waves is the Process where two or more Waves Come in Contact with each other; they join up and give a resultant wave. The nature of resulting waves is based on the type of Waves that interfares with each other. In Case the waves have different amplitudes and Same frequencies then the resulting wave also has the Same frequency but the resulting amplitude is the vector Sum of the Waves while if the wave has Same amplitude and different frequency then beats are formed. The resulting equations of more than three interfering Waves or up to N interfering Waves are also obtained in the Same way.

By using the Principle of Superposition the resultant displacement of many waves at any Point and at any instant of time can be found. This Principle stated that "The instantaneous displacement of the medium at any Point in Space or time is Simply the linear Sum of the individual displacements that would have occurred for each wave alone".

VKSU

According to Principle of Superposition when a number of waves Pass Through a Medium Simultaneously, the instantaneous resultant displacement of the medium at every instant is the algebraic sum of the displacements of the medium due to individual waves in the absence of others.

When $y_1, y_2, y_3, \ldots$ are the displacement vectors due to waves 1, 2, 3, -- acting separately, Then the resultant displacement y is given by,

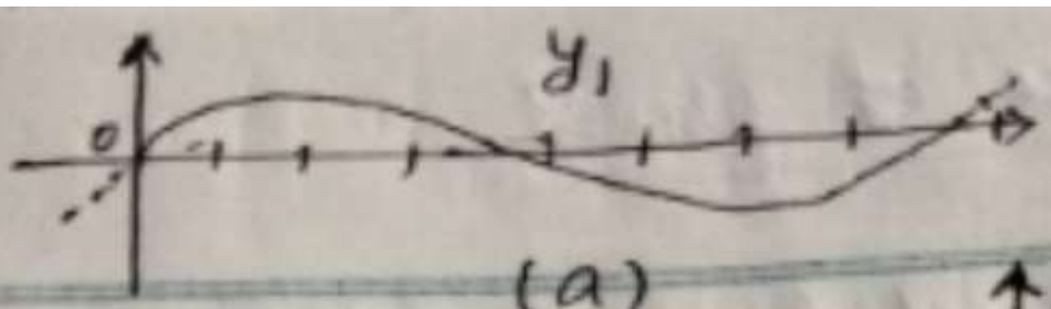
$$y = y_1 + y_2 + y_3 + \ldots \quad \text{---} \quad (1)$$

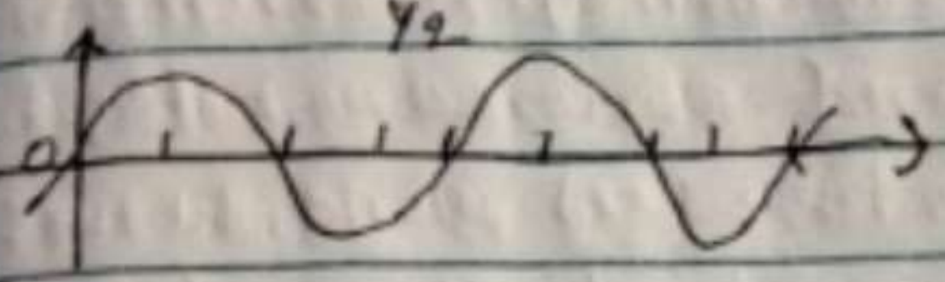
For example -

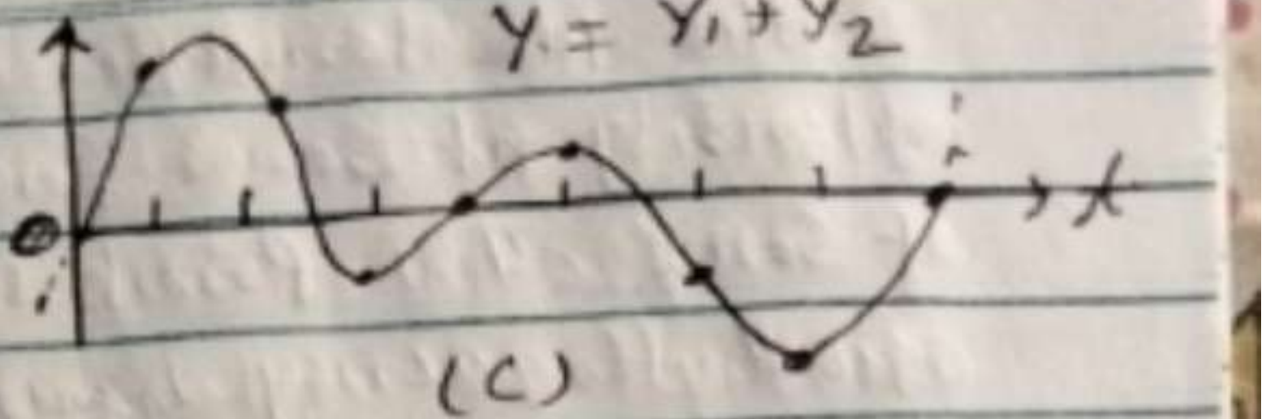
Let two waves travelling Simultaneously along the same Path. If $y_1(x,t)$ and $y_2(x,t)$ be the displacements that the Medium would experience if each wave travelled alone. When both the Waves overlap, Then the displacement of the Medium is;

$$y(x;t) = y_1(x,t) + y_2(x,t)$$

The Sum being an algebraic Sum fig: 1







Types of Superposition of Waves

When there are two or more waves that arrive at a Point simultaneously Then net displacement at that Point is the algebraic sum of the displacement because of individual waves.

$$y = y_1 + y_2 + y_3 + \cdots + y_n$$

In this equation $y_1, y_2, y_3, \cdots y_n$ are the displacement due to individual waves and y is the net resultant displacement.

Superposition of Waves

Interference	Beats	Stationary Waves
Two waves having Constant Phase difference ϕ = Constant	Two Sound Waves having Slightly difference in frequencies i.e $f_1 - f_2 < 10$	Two waves moving in ~~opposite~~ directions i.e. $f_1 = f_2$ and $A_1 = A_2$ where A_1, A_2 are ~~amplitudes of waves~~