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UG Sem II

MJC - 2

Wave Motion

Interference of waves



The phenomena of formation of maximum intensity at some points and minimum intensity at some other point when two (or) more waves of equal frequency having constant phase difference arrive at a point simultaneously, superimpose with each other, is known as interference.

Types of Interference of waves:

On the basis of phase difference in superimposing waves, the interference is divided into two categories which are discussed as follows:

1) Constructive Interference:

The phenomenon of constructive interference takes place when two waves superimpose on each other in the same phase, the amplitude of the resultant wave is equal to the sum of the amplitudes of individual waves resulting in the maximum intensity of light.

When phase difference is an even multiple of π or path difference is an even multiple of $\lambda/2$ then this interference is known as constructive interference.

when $\cos \phi = 1$ then resultant intensity will be maximum.

$$\Rightarrow \phi = 2n\pi$$

where, $n = 0, 1, 2, \dots$

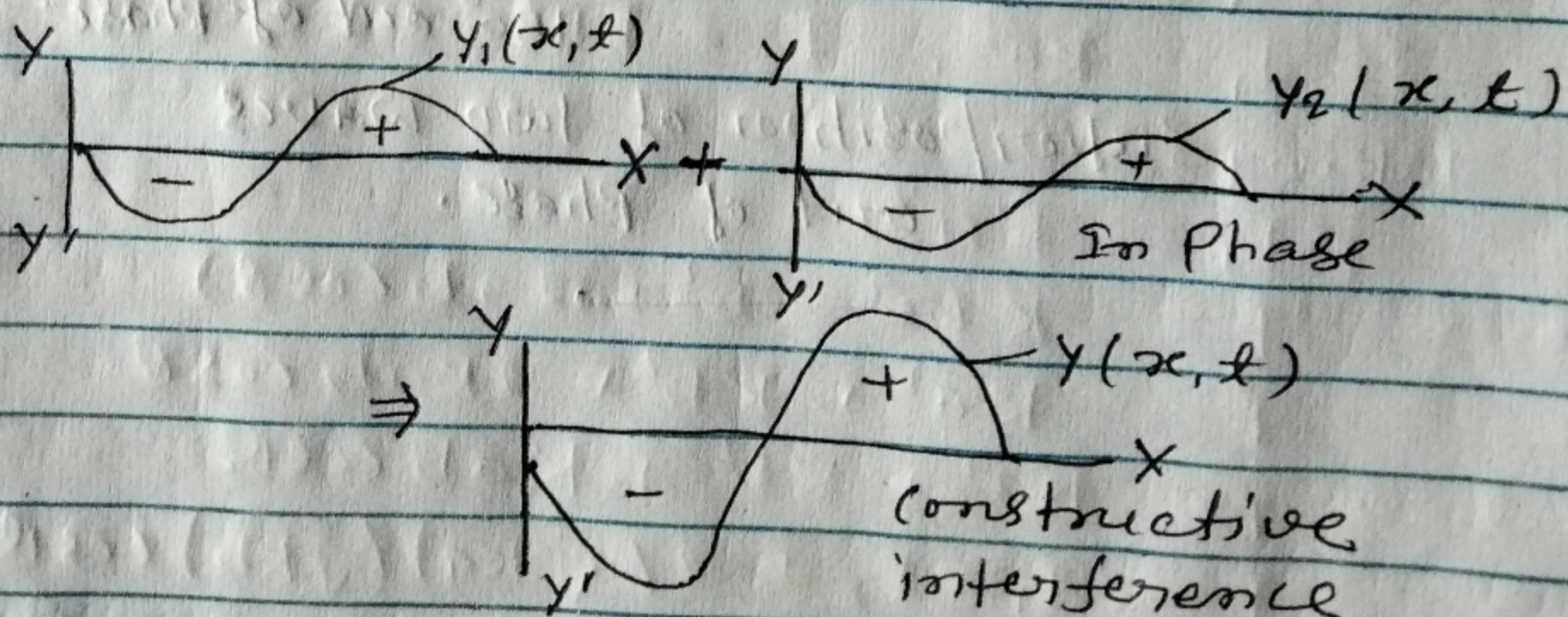
$$\Rightarrow \Delta x = (2n) \lambda / 2, \text{ where } n = 0, 1, 2, \dots$$

$$A_{\max} = |A_1 + A_2|$$

where A_{\max} = maximum resultant amplitude A_1, A_2 are the amplitudes of individual waves.

2) Destructive Interference:

Destructive interference is a phenomenon where two waves superimpose with each other in opposite phases; the amplitude of the resultant is equal to the difference in amplitude of individual waves, resulting in the maximum intensity of light.



Superposition of two waves in phase



When Phase difference is an odd multiple of π or Path difference is an odd multiple of $\lambda/2$. Then this interference is known as destructive interference.

Resultant intensity will be minimum if

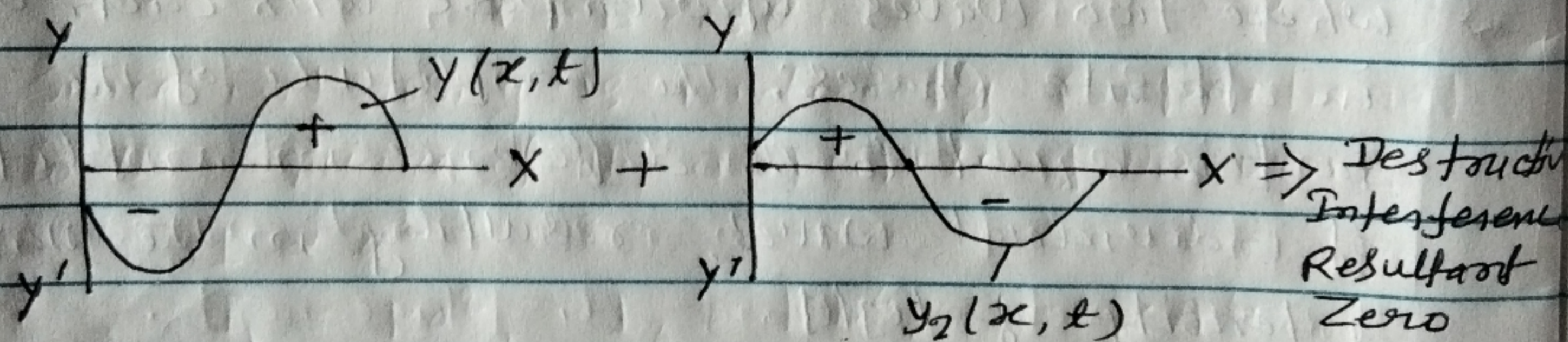
$$\cos \phi = -1$$

$$\Rightarrow \phi = (2n+1)\pi, \text{ where } n = 0, 1, 2, \dots$$

$$\Rightarrow \Delta x = (2n+1)\lambda/2, \text{ where } n = 0, 1, 2, 3, \dots$$

$$\text{And } A_{\min} = |A_1 - A_2|$$

where A_{\min} denotes minimum resultant amplitude and A_1, A_2 denotes the amplitudes of individual waves.



180° out of phase

Superposition of two waves out of phase.