MJC-7 UG- SEMESTER-4
2023-27

Chapter - Optics

TOPIC - Superposition of Waves

If two or more travelling waves are moving through a medium, the resultant value of the waves function at any point is the algebraic sum of the value of the individual waves.

The principle of superposition is the most important principle in wave optics. It also applies to electromagnetic wave. In EM waves, the term displacement refers to the amplitude of electric field vectors.

Interference is an important consequence of of superposition of coherent waves.

Linear waves - Waves that obeys this principle are called linear waves

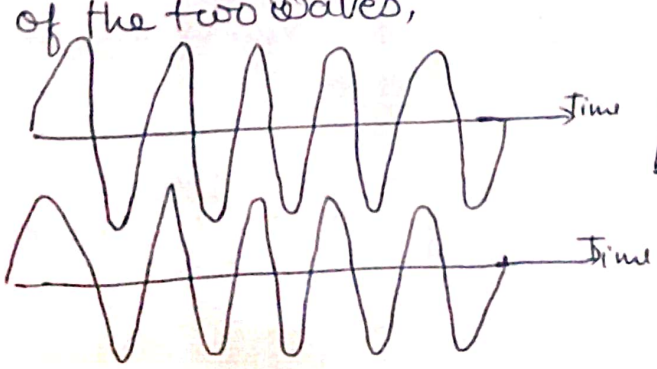
Non-linear waves - Waves that does not obey this principle are called non linear waves

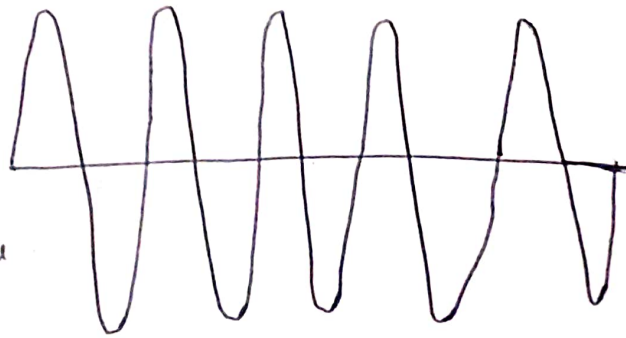
INTERFERENCE :-

If two or more light waves of same frequency overlap at a point, the resultant effects depends on the phase of waves and their amplitude. The resultant waves at any point at any instant of time is governed by the principle of superposition.

Let us assume here that the component waves are of the same amplitude.

At certain points, the two waves may be in phase. The amplitude of the resultant wave the sum of the amplitude of the two waves,





Thus, the amplitude of the resultant waves

$E_R = E + E = 2E$

Hence, the intensity of the resultant waves

$I_R \propto E_R^2 = 2E^2 = 2^2 I = 4I$

It is obvious that I_R = Resultant Intensity

$I_R > I + I = 2I$

Reoultant Intensity > the sum of intensitaes due to indivisual waves.

Therefore, the interference produced at these points is knoron as constructive interferouee. A stationary bright band of light is observed at point constructive interferouee.

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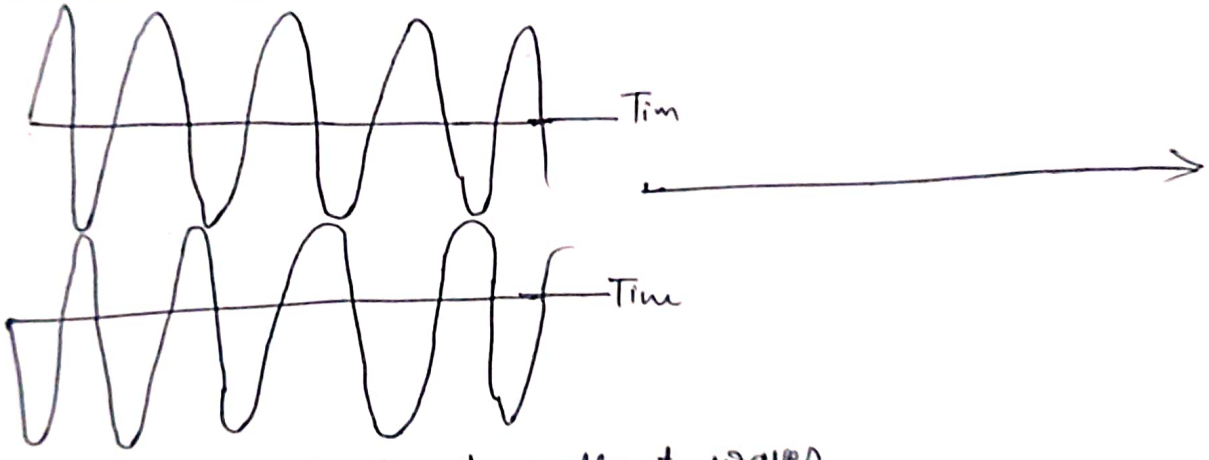

Thus the amplitude of reoultant waves

$E_R = E - E = 0$

Hence the resultant of intensitys waves

$I_R \propto 0^2 = 0$

It is obvious that

$I_R < 2I$

Reoultaot intensity > the sum of intensities due to individual waves.

$I_R < 2I$

Therefore, interference produceedat these points is called destructive interference. At these point, A stationary dark band of light is observed.